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THE IMPORTANCE OF THE PLANT CELL WALL TO THE FORESTER AND THE WOOD ANATOMIST

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ONE of the principal aims of the wood anatomist is to elucidate the structure of wood in its relation on the one hand to conditions of growth and on the other to technical properties. The anatomical structure of each species follows some well defined basic pattern, but it is subject to variations within wide limits owing to the influence of growth conditions. These variations, which are reflected in the physical and mechanical properties of the wood, may occur in the physico-chemical composition of the wood substance, in the amount of wood substance present in a given volume (i.e. density), or in the arrangement of the wood substance (e.g. as indicated by the proportion of summerwood in the growth rings, the relative proportions and dispositions of the vessels and thick-walled fibres, or the combination of features that goes to make up the 'texture' of wood). The significance of variations in density, growth rate, and the proportion of summerwood in the annual rings has received the attention of many investigators and is sufficiently well understood for these characters to be used in grading rules and in the formulation of silvicultural principles aiming at the production of timber of a desired quality. Valuable as the rules and principles unquestionably are, however, they are by no means complete. Experience shows that the factors in question together account for less than half the total variation in strength of English Ash [4], and specimens of Beech approximately identical in growth rate and specific gravity have been found to differ by as much as 2,800 lb. per sq. in. in maximum crushing strength [4]. There is considerable evidence that the unexplained variations in strength are largely accounted for by variations in the physico-chemical composition of the wood substance, and in recent years much attention has been given to studies of the fibre walls, which contain the bulk of the solid material in wood.

The principal constituent of the plant cell wall is cellulose. It is now accepted that cellulose occurs as elongated, threadlike molecules, or macromolecules. These threads have a very strong lateral attraction for each other, and much in the same way as mutually attractive molecules of common salt or sugar form crystals, so the threadlike molecules of cellulose are associated in groups in which crystal structure is detected by X-rays. The cellulose threads are not perfectly straight, however: they undulate slightly, and neighbouring threads are in contact through only a part of their length. One group of threads may run parallel and in association with another group for a short distance and then bend away to run in company with a third. Thus the structural pattern of the cell wall has been visualized as a very fine network in three dimensions, which if magnified some quarter of a million times would resemble a loofah. The cellulose framework is sometimes referred to as the micellar system, and the intervening spaces as the intermicellar system. It is believed that the intermicellar system accommodates lignin and other substances. Frey-Wyssling [7 (3)], who has given a very clear picture of these systems, likens the lignified cell wall to reinforced concrete, with the loofah-like system of cellulose corresponding to steel wire, and the lignin to the cement. With this picture in mind it is reasonable to suppose that the cell wall derives its high tensile strength and its toughness from the cellulose micellar system, and its rigidity and resistance to compression from the stiffening influence of the lignin of the intermicellar system.

The cellulose, or micellar system.

The arrangement of the cellulose threads in the cell wall has been studied by means of X-rays [14], by polarized light [1, 7, 14, 15], by direct observation of swollen material [16], and by micro-dissection [8]. There has been some difference in interpretation of the results [15], the reasons for which are not yet fully apparent; the view at present most widely accepted, however, and the one which has recently received support from direct observation by micro-dissection, is that in a typical fibre

there are many bundles of cellulose threads (called fibrils) running more or less parallel with the fibre axis, and that these are bound together by a winding of oblique, spirally running fibrils on the outside, and bordered by a similar inner winding around the cavity of the cell. Neighbouring cells are united by cementing layers which differ in structure and composition from the layers described above; the cementing layers are often very thin, and are even more difficult to study than the other parts of the cell wall. It is apparent, however, that they are usually very strongly lignified.

Reference has been made above to the high tensile strength of cellulose, but it would appear that this is not the limiting factor in determining either the toughness or the tensile strength of wood. Except in wood whose fibres have very thin walls or in which the bulk of the cellulose fibrils pursue a spiral instead of a straight course [11], or material in which the composition of the cellulose has been affected by fungal attack, chemical treatment, excessive heat or mechanical action [11, 12], the cellulose fibrils of the fibres do not break when wood fails in tension: failure normally occurs in the cementing layers of the fibre wall or else across the walls of the thin-walled elements such as vessels or parenchyma cells [4].

Münch [13 (5)] has recently advanced an ingenious hypothesis to explain how the arrangement of the long, slender, flexible, cellulose fibrils may contribute to the strength of wooden members. The tendency of longitudinal pressure on a tubular aggregate of fibrils such as compose the cell wall will be to cause it to buckle, but this tendency is counteracted by the outer spiral winding. The longitudinal pressure forces the longitudinally-running fibrils outwards against the outer spiral of fibrils, which tends to unwind, so that the fibrils receive the centrifugally directed pressure as a tensile stress, which they are well fitted to withstand. Conversely, argues Münch, the system is advantageous in resisting tensile stresses; these, he suggests, tend to decrease the diameter of the outer spiral, so that the longitudinal tensile stress produces an inwardly directed radial pressure which, transmitted to the longitudinally-running fibrils, increases their cohesive power. The conclusion is reached that the typical structure of the fibre wall is well suited to transform longitudinal into transverse stresses and *vice versa*. If future discoveries justify Preston's objections to the view that the direction of the cellulose threads varies distinctly in at least two layers of the fibre wall [15], Münch's suggestion will have to be rejected.

Münch further suggests that during formation the fibrils of the secondary wall undergo an irreversible swelling as a result of which they exert a radial pressure on the outer layers of the wall, tending to compress the spiral windings and to shorten the cell, in a manner reminiscent of a moistened rope. Since each fibre is laid down by the cambium in a more or less plastic condition against the surface of fibres already formed, as Jacobs [10 (5)] points out, any tendency to shorten places the new fibre in a slight tension with regard to its immediate neighbour, which is at the same time subjected to a slight longitudinal compression. It follows that in the course of continued diameter growth, fibres originally laid down in a state of tension are ultimately found in a state of compression; there is a steadily accumulating longitudinal compressive stress which is greatest at the centre of the tree. It may be imagined that the extent of the stress will vary with the conditions operating at the time of growth. Münch demonstrated the extent of these latent stresses by cutting a leaning stem through and through into boards. Boards from both the upper and lower sides of a branch from a softwood tree increased slightly in length, whereas the inner boards decreased slightly in length. In the leaning stem of a hardwood tree the reverse was found, the upper and lower sides being in tension and the middle in compression. A careful consideration of the amounts of change in length of the individual boards of both softwood and hardwood, however, revealed that in each case the latent stresses were such as would tend towards the erection of the leaning stem. Münch concluded that tension wood and compression wood (collectively spoken of as 'reaction wood') are tissues with latent stresses whose function is to restore leaning members to a vertical position, or to maintain them in a suitable position with regard to light, in face of the action of gravity.

Jacobs has shown that similar stresses, though not of such a high order, occur in all trees. He believes that it is normal for the centre of the tree to be in a state of longitudinal compression, and in remarking that such a condition may be of importance in keeping the tree rigid, quotes by way of parallel the influence of osmotic pressure in a turgid cell in maintaining the rigidity of a herbaceous structure. An obvious consequence of a longitudinal tension towards the outside of the tree and a longitudinal compression towards the inside is a tendency of the tree trunk to split down a diameter plane and separate into halves. This, it is averred, is the explanation of heartshakes. It would be

anticipated on these grounds that once a major heartshake developed there would be an immediate tendency for similar splitting across the two halves to produce secondary shakes at right angles to the first, and this frequently occurs.

A further consequence of the variation in longitudinal stress from pith to bark is that pieces cut from the tree show varying tendencies to bow according to their size and the position from which they came. Tensions are released when the log is converted, and again when pieces are re-sawn, and on each occasion there is a greater or smaller change in shape in the cut pieces. There is evidence that tensions persist in seasoned wood. From his observations of the movement of sawn material Jacobs computes that in time the longitudinal stresses may become sufficiently great to be responsible for the minute natural compression failures ('thunder shakes') which are frequently found in the 'brittle heart' near the centre of many large tropical trees. It is even possible that the stresses are the cause of 'brittle heart'.

Koehler has attributed heartshakes to the influence of stresses operating at right angles to the grain. 'When a radial cut is made in a green disc from bark to pith it will close up tightly near the periphery', indicating 'that the outer part of a green trunk is in compression tangentially'. A little reflection will show that such a tangential compressive stress must be accompanied by a radial tensile stress, and it is suggested that herein lies the explanation of the fact that heartshakes commonly open at the centre of the cross section but do not extend to the bark. It is possible that the stresses mentioned by Koehler arise by the same process at cell formation described by Münch.

The intermicellar system.

The view that lignin increases the resistance of the cell wall to compression has been repeatedly confirmed by the observation that in the green condition, and weight for weight, specimens with strongly lignified fibres are stronger in compression than those with weakly lignified fibres [4]. The unusually great difference in strength between the specimens of Beech mentioned above was explained in this way.

Variations in degree of lignification influence other properties besides strength. It is well known that as wood dries from the green condition there is no appreciable change in volume or in the mechanical properties until fibre saturation point* is reached. In a recent comparison [6] of groups of timbers differing in degree of lignification it was found that the more strongly lignified timbers had on the average a slightly lower fibre saturation point, and in an atmosphere of 90 per cent. relative humidity they reached equilibrium at a slightly lower moisture content than the more weakly lignified timbers. As the timbers dried below fibre saturation point the more weakly lignified timbers showed a greater proportional increase in strength than the more heavily lignified timbers. Consequently, in the air-dry condition the difference in strength between strongly and weakly lignified timbers was less than in the green condition. The comparison was made on a weight-for-weight basis.

Influence of growth conditions on the cell wall.

Since the cell wall has such an important influence on the properties of timber it will be of interest to the forester to enquire how it is affected by growth conditions. Although indications of the importance of growth conditions in this connexion are not wanting, unfortunately very little is at present known of their action.

It has been found, however, that on the whole, tropical timbers are more strongly lignified than temperate timbers, and in comparison they show all the differences in properties attributed above to differences in degree of lignification [4]. There are as yet no indications as to what peculiarities of climate or habitat are of importance in this connexion.

A second line of enquiry has been concerned with the properties of the tension wood and compression wood of leaning trees. In both hardwood and softwood trees, wood from the lower sides of leaning members is more strongly lignified than that from the upper sides of the same stems. Weight for weight the more strongly lignified wood from the lower side of hardwood stems is much stronger in resistance to compression than the tension wood of the upper side. As already mentioned,

* Barkas [2] has shown the conception of fibre saturation point as the moisture content at which the cell lumina are empty but the walls are saturated with water to be without practical basis. The use of the term in connexion with the change in direction of the curves relating physical properties to moisture content is still valuable for many purposes.

the inclination of the stem also affects the course of the cellulose fibrils, and apparently also the degree of fibre tension.

General conclusions.

The failure of the more readily observed characters to account for variations in the properties of wood has helped to focus attention on the importance of the physico-chemical composition of the cell wall. Up to the present only the fringe of the subject has been touched, but clear indications have been obtained of the influence of the cell wall on the mechanical properties and moisture relations of wood. It is apparent that in some respects cell-wall composition is an over-riding factor in determining the properties of timber; there can be little doubt, for instance, that the remarkable toughness of Hickory, Ash and Birch, and the working properties of Box are attributable in no small measure to characteristics of the cell wall.

Of no less interest are the indications of the influence of climatic and other conditions of growth on the degree of lignification, and of the fact that the inclination of a tree or branch has a bearing not only on the lignification of the cell walls but also on the inclination of the cellulose spirals within the fibre wall, and on the intensity of the stresses locked in the wall. A deviation of only a few degrees from the vertical is sufficient to stimulate the development of an appreciable amount of reaction wood [9]. At present it is only possible to apply this knowledge in a limited degree to practical problems, such as the selection of timber for special purposes, or the explanation of the unusual behaviour of particular specimens. Strong emphasis is laid, however, on the necessity for the production of straight, evenly grown, upright trees. It is a common forestry practice to leave young crooked stems, for instance those that have lost the leading shoot, in the hope that they will in time produce a straight stem; the pith of such trees always pursues a crooked course, however, and any apparent straightening is due to deposition of new wood in layers of irregular thickness. It may well be that this process is attended by the development of excessively great fibre tension which affects the behaviour of the whole stem.

Foresters may make valuable contributions to the advancement of knowledge by furnishing examples of species in which the properties are observed to depend on locality of origin, especially where the variations do not permit a ready explanation on grounds of anatomical structure.

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ECOLOGICAL REQUIREMENTS AND CULTIVATION OF *CINCHONA*, WITH PARTICULAR REFERENCE TO *C. SUCCIRUBRA*

During the past year enquiries have been received for information on the cultivation of *Cinchona* and on the range of conditions under which it can usefully be grown. It has been suggested that an outline of the more important points in this regard might be of interest to a number of Forest Departments, and so the following summary of data is presented. Details on many points can be found in the references listed at the end.

Of the 65 known species of *Cinchona* only two are now considered worth intensive cultivation —*C. ledgeriana* [*C. calisayana* var. *ledgeriana*] and *C. succirubra*. The former is generally recognized as the best source of quinine and is by far the most extensively grown, especially in Java, which produces the bulk of the world supply of cinchona bark. *C. succirubra* is the hardiest species of the genus, and is therefore much used as a grafting stock for *C. ledgeriana*; its alkaloid content, however, is lower than that of *C. ledgeriana* and it is a rather less satisfactory producer of quinine.

Climate.

For Cinchonas in general the optimum temperatures are believed to be:—minimum 4° C. [39° F.], maximum 33° C. [91° F.], average of minima 15° C. [59° F.], average of maxima 27° C. [81° F.], and general average 21° C. [70° F.]. Even for *C. succirubra* the temperature should not fall below freezing often or for any length of time; in 1934 one night of frost in Java produced little outward change in mature trees but considerably reduced their alkaloid content, *C. ledgeriana* being more affected than *C. succirubra*.

Cinchonas need a relatively high humidity and a well distributed annual rainfall of between 75 and 180 in., the optimum depending largely on soil drainage. Periods of drought longer than 3–4 months are harmful unless dense fogs occur during the dry season or irrigation is practised. Irrigation does not entirely make up for lack of precipitation, as high alkaloid yields appear to be correlated with high humidity. *C. succirubra* suffers more than other species from strong winds, and in windy places the trees should be closely spaced and protected by surrounding forest vegetation.

Annual temperature averages and total rainfall of some regions where Cinchona is cultivated are:

Locality	*Annual average temperature*	*Total annual rainfall*
Andes–Bogotá [8,530 ft.]	15° 30 [15° 12–15° 88]	74 in.
India–Nilgiris [6,070 ft.]	16° 60 [14° 82–18° 61]	82 in.
Ceylon–Rambodde [4,928 ft.]	21° 67 [20°–24° 44]	169 in.

Altitude.

As regards altitude, *C. ledgeriana* succeeds in Java between 3,500 and 6,000 ft., the optimum range being about 4,900–5,400 ft. above sea level; whereas *C. succirubra* has given good results at 3,000–6,500 ft. and has been successful at two stations in the Belgian Congo at 5,250–6,900 ft. Plantations below 3,200 ft. have rapid early growth, a short life, and are susceptible to disease, while those above 7,000 ft. are of slow growth and low yield. Experiments with Cinchonas at elevations as low as 1,500 ft. also show a very low yield of quinine.

Soil.

The essential soil requirements of the Cinchonas are good drainage and a high proportion of organic matter. The least water-logging is fatal to *C. ledgeriana* and definitely undesirable for other species; deep, light, friable soils over a porous subsoil are therefore desirable. The pH should lie between 4·5 and 6·5, and the C/N ratio between 8·5 and 10·8. In general, the ecological conditions favourable to Cinchona are those that support a natural vegetation of evergreen rain forest. Recent work has shown the advantage of fertilizers, particularly nitrogenous and phosphate manures, where soil fertility has become depleted.

Nursery and planting.

Owing to the extreme sensitiveness of seedling stock to light and its susceptibility to damping-off, special nurseries are necessary. Seed is sown thinly on specially prepared beds of humus soil; watering is done by a fine mist spray and limited to avoid fungus damage; and the shading of the beds is carefully graded with the age of the seedlings so as to accustom them gradually to light. The first transplanting is usually done at 4–6 months, when the plants are 3–4 in. high; a second transplanting may follow at the end of a year if necessary. Partial shading of the seedlings is continued to a late stage in their nursery life, often to as much as 16–18 months. Planting out may be done as soon as the stems become woody, which is usually at an age of 1½ to 2 years. The seedlings are selected for vigour and resistance to disease, pruned back to a height of about 2 ft. and stripped of most of their leaves; they are then planted out, early enough to establish themselves before the dry weather, in specially prepared pits 18 in. deep and 1 ft. in diameter. The raising of plants from cuttings requires greater care and does not give as good results as seeding, and has largely been abandoned.

If possible, ground cleared for plantations should not be burnt over, as this reduces the content of organic matter. Well wooded land, preferably of evergreen forest on granitic or volcanic rock formations, is most suitable. Flat sites may be used if the drainage is good, or slopes may be fairly steep; in the latter case contour terraces are made to prevent erosion of the rich humus soil. In Java cultivation to a depth of at least 1 ft. is undertaken before the terraces are lined out. Some side shelter appears to be advisable to maintain atmospheric humidity.

Close spacing of the plants is said to give early yields from thinnings but to reduce later yields from prunings and to cause premature fruiting at the expense of growth in dry climates. The normal spacing in plantations is from 3×3 ft. to 4×4 ft., and with this spacing closure is obtained in 2–3 years. 'Closeness' of spacing, however, varies with the vigour of the trees used; experiments with *C. succirubra* in the Belgian Congo suggest that 'close' spacing—in this case 5·7×5·7 ft.—and early transplanting [8–12 months after sowing] have advantages for this species.

Cultivation.

Weeding and hoeing to prevent weed growth are the most important operations in young plantations. Leguminous cover crops may be grown in the first years to improve soil conditions. Little manure is used and what is used is essentially a nitrogenous fertilizer of the coconut, ground-nut and castor meal type with small amounts of other plant foods, and is applied at the rate of about 250–300 lbs. per acre after a crop has been harvested. Pruning takes place at an early stage to obtain preliminary yields and to stimulate height growth. Replacements are generally made where gaps occur, and though the usual rotation of a single age class is 8–10 years, a plantation can be maintained for 25–30 years or longer by gradual replacement of the poorer trees.

Selection is much practised in Java, the factors favoured being:—strong healthy growth, erect stem, and erect branching habit; strains with reddish leaves of medium size, thick bark with a high quinine content; trees that do not flower before 6–8 years; and resistance to diseases and pests. Propagation by clones is used extensively in furthering the results of selection.

In conclusion, an interesting Russian technique deserves mention, whereby *C. succirubra* has been successfully grown on an experimental scale as a field crop on light, strongly humic soils in Georgia. Here the seedlings spend their first year in hot-beds, are planted out in April–early May, and are harvested in November when they are 60–80 cm. high. The plants harvested contain 1·25 per cent. of medicinal alkaloids, calculated on the basis of dry weight of the whole plant, and it is estimated that the yield of alkaloids per hectare per rotation will be 40–70 kg.

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ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

0. GENERAL FORESTRY

01. TERMINOLOGY. METHODS

01 : 07. WISHART, J. **Field trials: their lay-out and statistical analysis.** Imperial Bureau of Plant Breeding & Genetics, School of Agriculture, Cambridge. 1940. pp. 36.

01 : 12.2. **British standard nomenclature of hardwoods (including botanical names and sources of supply).** *British Standard*, No. 881, 1939. pp. 73. P.R.

07. EDUCATION AND RESEARCH. TRAVEL AND STUDY

07 : 01 (71). **Classification for forest research projects of the Dominion Forest Service.** *Silvic. Res. Note Dom. For. Serv.* No. 61, 1939. pp. 22.

Forest research projects are classified under the main divisions of botany, ecology, silviculture, mensuration, influences, protection, administration, economics, technology, and utilization. Examples are given of projects under subdivisions of the main headings, except in the case of wood technology, which is dealt with by the Forest Products Laboratories.

07 (74). HEIMBURGER, C. C. **Some observations on a visit to New England and New York, Sept. 13 to 21, 1938.** *Silvic. Res. Note Dom. For. Serv.* No. 60, 1939. pp. 26.

09.2. *Pre-history*

09.2 : 09.7 (44). MARCELIN, P. La préhistoire et la forêt dans les Cévennes. **[Prehistory and forests in the Cévennes.]** *Rev. Eaux For.* 78, 1940 (77–97). [F.]

09.4. *Forest Statistics*

09.4 : 01. HODGINS, H. J. **Mechanical tabulation of forest data.** *For. Chron.* 16, 1940 (85–93).

The 'Hollerick Punch Card System', which is being adapted to the forest resources inventory of British Columbia, is discussed. 'The main advantage of the system is the ease with which value data can be recapitulated under various classifications of descriptive data'.

09.4 (4). Étendue boisée du globe. Répartition des forêts en Europe. **[The forested area of the world. Distribution of forests in Europe.]** *Bull. Soc. for. Belg.* 47, 1940 (163–7). [F.]

09.4 : 05.3 (43.1–5). Die Wirtschaftsergebnisse der Preussischen Staatsforstverwaltung im Jahre 1937. **[Results of the activities of the Prussian State Forest Administration in 1937.]** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (313–400). [G.]

09.4 : 05.3 (47.4). LITHUANIA. Lietuvos miškų statistika 1937 m. **[Lithuanian forest statistics for 1937.]** Kaunas. 1939. pp. 298. [Lith.; tables in Lith. & F.]

09.4 : 05.3 (489). DENMARK. Oversigt over de danske Statsskoves Udbytte af Ved og Penge for Finansaaret 1938–9. **[Review of the financial and timber outturn of the Danish State forests during the financial year 1938–9.]** Nielsen & Lydiche (Axel Simmelkiær), Copenhagen. 1940. pp. 10. [Da.]

09.4 (494). Schweizerische Forststatistik 1938. 11. Lieferung/4. Heft. **[Swiss forest statistics, 1938. Vol. II, pt. 4.]** *Statistische Quellenwerke der Schweiz* Heft 91, Reihe Ct8, 1939 [?]. pp. 28. [G.F.]

09.4 : 23.3 (494). HESS, E. Le taux de boisement de la Suisse. **[The percentage area of forest in Switzerland.]** *J. for. suisse.* 91, 1940 (7–15). [F.]

Only about 26,000 ha. have been afforested in Switzerland during the past 60 years. This has increased the percentage area of forest by ·5 per cent. For a mountainous country the present Swiss percentage area of forest of 24·3 is relatively low, and many valleys in the Alps are still inadequately wooded.

09.4 : 05.3 (54). INDIA. **Annual return of statistics relating to forest administration in British India for the year 1937-38.** Manager of Publications, Delhi. 1940. pp. 40.

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09.4 : 6 (71.4). WILSON, J. O. **Report on forest inventories—Province of Quebec.** *Pulp Paper Mag. Can.* 41 (2), 1940 (178–80). [Anglo-Canadian Pulp & Paper Mills, Limited.]

Statistics are given on forest areas classified by type of ownership and timber volume by species. The figures are considered briefly in relation to pulpwood supplies and their accessibility. It is concluded that the total annual drain on the forest for 1935–6, representing 1·58 per cent. of the accessible merchantable stand, was within the margin required for sustained-yield management. The available figures, however, are only approximate and must be viewed with caution.

09.4 : 33.32 (73). UNITED STATES. **Forest products: 1938. Paper and paperboard production and paper-making machines in use. Pulpwood consumption and wood-pulp production.** Bureau of the Census, U.S. Department of Commerce. 1939. pp. 13.

09.4 : 33 (74 : 75.1–3). REYNOLDS, R. V., and PIERSON, A. H. **Forest products statistics of the Northeastern States.** *Statist. Bull. U.S. Dep. Agric.* No. 70, 1940. pp. 109. [Division of Forest Economics, U.S. Forest Service.]

09.4 (75.6). CRUIKSHANK, J. W. **Forest resources of the southern coastal plain of North Carolina.** *For. Surv. Release Appal. For. Exp. Sta.* No. 4, 1940. pp. 46.

09.4 : 09.7 (75.6). NORTH CAROLINA. **The forest situation in North Carolina.** *Circ. N.C. Dep. Conserv.* No. 23, 1939. pp. 25.

09.4 (76.1). SPILLERS, A. R. **Forest resources of southeast Alabama.** *For. Surv. Release Sth. For. Exp. Sta.* No. 47, 1939. pp. 32.

09.4 : 09.7 : 97.1 (76.3). SONDEREGGER, V. H. **Classification and uses of agricultural and forest lands in the State of Louisiana and the Parishes.** *Bull. La. Conserv. Dep.* No. 24, 1939. pp. 124.

09.4 : 33.52 : 12.2 (79.6–7). **Western Red Cedar pole resources in north Idaho and northeastern Washington.** *For. Surv. Release Nth. Rocky Mt. For. & Range Exp. Sta.* No. 16, 1939. pp. 36.

09.7. *Forest Geography. Distribution of Forests. Monographs*

09.7 (44). GAUSSEN, H. La forêt des Landes méridionales. **[The forest of the southern Landes.]** *Trav. Lab. for. Toulouse*, Tôme 3, Vol. I. Art. 15. 1939. pp. 26. [F.] (Extract from *La Revue Géographique des Pyrénées et du Sud-Ouest*, Tôme 10, 1939).

09.7 : 09.4 : 9 (498). DINU, V. Der Wald als Glied der rumänischen Volkswirtschaft. **[The rôle of forests in Rumanian national economy.]** *Z. Weltforstwirt.* 6, 1939 (767–89). [G.e.]

The over-expansion of the Rumanian sawmill industry, which now has twice to three times the capacity normally required, and exports in excess of the productivity of Rumanian forests, have diminished the coniferous growing stock in the course of the last 40 years. In future, softwood exports will have to be reduced, but there are still good possibilities for increasing the export of Beech.

09.7 (54.1). COFFEY, T. M. **The Chittagong Hill Tracts Forest Division.** *Indian For.* 66, 1940 (16–29).

A general description of the forest conditions and work in this district in south-east Bengal. The forest types occurring there are the tropical wet evergreen, the tropical semi-evergreen, the tropical moist deciduous, Bamboo, and savanna. Marketable species in the top storey of the first and second types include *Dipterocarpus turbinatus*, *D. pilosus* and *Swintonia floribunda*, in the second storey *Artocarpus*

chaplasha, Dichopsis polyantha, Amoora spp., *Eugenia* spp., *Mesua ferrea* and *Calophyllum polyanthum*, and in the third storey *Taraktogenos kurzii* and *Podocarpus neriifolia*. Cane (*Calamus* spp.) grows throughout these forests. Marketable species in the deciduous type include *Tetrameles nudiflora, Sterculia alta, Bombax malabaricum, Gedrela toona, Lagerstræmia flosreginæ, Gmelina arborea* and *Trewia nudiflora*.

Management is based on clear cutting and artificial regeneration with an eighty-year rotation. The plantations in the forest villages are raised in combination with field crops. Teak is the main species planted in a number of districts, but where the soil does not favour Teak some of the indigenous species as noted above are being planted. It appears probable that a number of these species can be reproduced naturally.

There is a local demand for practically all wood extracted. From exploitation data it appears that the work capacity of an old model petrol-driven, 25 draw-bar h.p. caterpillar tractor is equivalent to that of ten elephants.

09.7 : 09.2 : 96 (68.7). KING, N. L. **The Knysna forests and the woodcutter problem.** *J. S. Afr. For. Ass.* 3, 1939 (6–15). [Division of Forestry, Union of South Africa.]

An historical account of the woodcutter problem in the George–Knysna–Tzitzikama area and of the events which lead to the repeal of regulations for the control and management of the Crown Forests in the Districts of George, Knysna, and Humansdorp, and to the passing of the Woodcutters' Annuities Act in 1939.

09.7 (729.3). ERICKSON, T. El Servicio Forestal en la Republica Dominicana. **[The Forest Service in the Dominican Republic.]** *Carib. For.* 1 (2), 1940 (13–16). [Span.e.]

09.7 (729.4). NICOLAS, S. **Forestry and forest resources in Haiti.** *Carib. For.* 1 (2), 1940 (7–9). [E.e. span.]

09.7 : 11.6 (729.4–5). SWABEY, C. **Forestry and erosion in Haiti and Puerto Rico.** *Bull. Dep. Agric. Jamaica (n.s.)* No. 21, 1939. pp. 11.

Land problems in Haiti have resulted from excessive deforestation. Ineffective legislation in the past, lack of forest reserves and a re-afforestation programme, and insecurity of tenure are factors that must be considered in any programme for land improvement.

Puerto Rico has a total forest area of 88,000 acres (4 per cent. of the country) and an annual appropriation of £400,000 spent by the Forest Service. An area of 20,000 acres of denuded lands has been re-afforested. Problems of erosion research and land planning, as undertaken by the Soil Conservation Service, are discussed.

09.7 (729.9). HAGLEY, W. H. **Forestry in Grenada.** *Carib. For.* 1 (2), 1940 (5–6). [E. span.]

09.7 : 09.4 (931). **Forestry in New Zealand.** *Misc. Ser. N.Z. For. Serv.* No. 1, 1939. pp. 23.

Includes information on the activities of the State Forest Service, the output and consumption of timber, and the financial aspect of commercial afforestation.

09.7 (945). GALBRAITH, A. V. **Forestry in Victoria.** *Aust. Timb. J.* 6 (1), 1940 (11–5).

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.1. *Atmosphere*

11.14. Precipitations. Evaporation. Humidity

11.14 : 12.19 (213). VOTH, P. D. **Conduction of rainfall by plant stems in a tropical rain forest.** *Bot. Gaz.* 101, 1939 (328–40). [University of Chicago.] O.B.D.

Cups fixed to the stems of small *Annona* and *Myriocarpa* trees, the former in a laboratory clearing and the latter in rain forest on Barro Colorado Island, Canal Zone, collected 6–7 times as much water as the rain gauge. The water collected by a cup on a leafless control stem was 80–104·2 per cent. of that in the rain gauge. From these and other results it is concluded that the water draining down the stems of woody plants in tropical rain forest during the rainy season is sufficient to support a copious growth of epiphytes: therefore lack of water is not the factor responsible for the scarcity of epiphytes on many stems in the region studied.

11.2. *Climate*

11.2 (43.1–5). BOOS. Untersuchungen über das Bestandesinnenklima im Preuss. Forstamt

Erdmannshausen. **[Research on the microclimate of stands in the forest district of Erdmannshausen in Prussia.]** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (254–62). [G.g.] [Waldbau-Institut 2 der Forstl. Fakultät der Georg-August-Universität in Hann.-Münden.]

The range of temperature variation in the litter layer was smaller under a close canopy than under a more open one. The amount of rain reaching the ground was found to depend to a considerable extent on the presence or absence of an understorey. For instance, 37 per cent. of the total precipitation reached the ground under a 90-year-old Pine stand of 0·4 density with a dense, 25-year-old understorey of Silver Fir, whereas 76 per cent. reached the ground under a similar Pine stand without an understorey.

11.2 : 22.4 : 13.2 (66.9). NASH, T. A. M. **The effect upon *Glossina* of changing the climate in the true habitat by partial clearing of vegetation.** *Bull. ent. Res.* 31, 1940 (69–84). [Sleeping Sickness Service, Nigerian Medical Department.]

In an experiment at Gadau, in Northern Nigeria, on clearing for tsetse control, it was found that the removal of the thicket windbreak from around a residual forest island considerably altered its climate and intensified the severity of the dry season. The evaporation rate rose considerably. Appreciable increases were observed in the diurnal atmospheric temperature, but were even more pronounced in the soil temperature. The island became slightly cooler at night. Thinning of seedlings on the forest floor increased the climatic differences, especially for evaporation near the soil surface. The bulk of the paper is devoted to the effect of these climatic changes upon various species of tsetse fly.

11.4. *Soil*

11.41. Soil Physics

11.41 : 07.7. SHAW, B., and BAVER, L. D. **A thermo-electric method for following moisture changes of the soil *in situ*.** *Abstract* of paper read at a meeting of the Society of American Foresters, Dec. 1939, in *J. For.* 38, 1940 (225). [Ohio State University.]

This method is based on the fact that the heat conductivity of a soil increases with its moisture content. The instrument used for measurement is essentially a wheatstone bridge, one arm of which is placed in the soil. This arm consists of No. 40 enamelled copper wire wound on glass tubing. The other three bridge resistances are made of manganin wire. As the current is forced through the bridge, the resistance of the soil arm increases, the magnitude of the increase being dependent upon the heat conductivity of the soil. Results are not affected by changing salt concentrations in the soil solution.

11.41 : 11.46 (75.6). DUNCAN, W. H. **Wilting coefficient and wilting percentage of three forest soils of the Duke Forest.** *Soil Sci.* 48, 1939 (413–20). [Department of Botany, University of Georgia.] O.R.E.

The soils examined were Congaree clay loam, Georgeville clay, and Orange loam. In the two latter, moisture equivalent values were higher in sifted than in unsifted soil. Moisture equivalent values for the lower soil horizons appeared to be directly correlated with colloid content, while those for the surface horizons appeared to be directly correlated with organic content. Wilting percentages, though much lower, followed the general trend of the moisture equivalent values, apparently being conditioned by the same factors. The ratio of moisture equivalent to wilting percentage varied from 1·57 to 5·65. Wilting coefficient values varied considerably from those of the wilting percentage; the wilting coefficient is, therefore, not a good measure of the lower limit of available water in the soils examined. *From author's summary.*

11.42. Soil Chemistry

11.42 : 31.3. KÜRSCHNER, K., and SCHINDLER, F. Bemerkungen über die Trennung von Ligninen und Humusstoffen. **[Observations on the separation of lignins and humous substances.]** *Papierfabrikant* 38 (5/6), 1940 (34–6). [G.] P.R.

It is shown that acetyl bromide is capable of dissolving humous substances as well as lignin and so cannot be used for separating the two.

11.43. Biology of Soil including Mycorrhiza

11.43 : 01. KELLEY, A. P. **Additions to the literature of mycorrhizae.** [*Suppl.* No. 3 to 'The literature of mycorrhizae'.] Landenberg, Pa. 1939. pp. 19.

A current bibliography with abstracts.

11.43 : 12.2. HARLEY, J. L. **Beech mycorrhiza: re-isolation and the effect of root extracts upon *Mycelium radicis fagi* (Chan).** *New Phytol.* 38, 1939 (352–63). (Repr.)

A fungus isolated from the 'pyramidal' type [Cf. Harley in *J. Ecol.* 25, 2, 1937] of Beech mycorrhiza is described. This fungus was similar to *Mycelium radicis fagi* Chan and was considered to be of the same species. Its growth was extremely slow in pure culture, and was found to be stimulated by an extract of Beech roots, for which a method of preparation is given. A technique for cleansing the surface of the roots of Beech is also described.

11.43 : 12.2. LIHNELL, D. Untersuchungen über die Mykorrhizen und die Wurzelpilze von *Juniperus communis*. **[Research on the mycorrhizae and root fungi of *J. communis*.]** *Symb. bot. upsaliens.* 3 (3), 1939. pp. 141. [G.] L.S.

A detailed monographic study. Juniper roots, from about 50 localities in Sweden, examined during 1932–8 at the Uppsala Botanical Institute were all covered with a mycelial network. This network varied in density and consisted largely of hyphae of *Mycelium radicis atrovirens*. Almost all the mycorrhizae were endotrophic, ectotrophic mycorrhizae of the *M.r. nigrostrigosum* type being found on roots from only two of the localities represented.

11.43 : 12.2. HOW, J. E. **The mycorrhizal relations of Larch. I. A study of *Boletus elegans* Schum. in pure culture.** *Ann. Bot., Lond.* (*n.s.*), 4, 1940 (135–50). R.A.M. 19 (297).

The results of this pure-culture study gave no clue to the relationship of the fungus to the host. It is concluded that a pure-culture study is unlikely to solve the problem of the behaviour of a soil fungus such as *Boletus elegans*, and that further studies should be directed to the fungus in relation to other members of the soil flora and the host plant.

11.43 : 12.2. BJÖRKMAN, E. Om mykorrhizans utbildning hos tall- och granplantor, odlade i näringsrika jordar vid olika kvävetillförsel och ljustillgång. **[On the development of mycorrhiza in Pine and Spruce seedlings grown under varied light intensities in rich soils with or without added nitrate.]** *Medd. Skogsförsöksanst. Stockh.* 32, 1940 (23–74). [Sw.sw.c.]

Root development and the formation of mycorrhiza were studied in 1-year-old Pine and Spruce seedlings grown under varied illumination (between 6 and 49 per cent.—in some experiments 76 per cent.—of that in the open), and in 8 different soils (6 forest mulls, a mor mixed with sand, and a garden soil) which were used either in their natural state or with ammonium nitrate added up to very high dosages.

With adequate light the development of mycorrhiza in untreated soils was not correlated with the degree of natural nitrification, nor was it perceptibly influenced by the pH, which varied from 4·5 to 7·5. In all the soils mycorrhiza reached high percentages and was relatively well developed.

In both Pine and Spruce seedlings the addition of nitrate tended to decrease mycorrhizal development, as judged both by the percentage of short roots converted into mycorrhiza and the number of mycorrhiza to each seedling. This decrease was particularly marked when the doses of nitrate were large. A high soil nitrate content did not, however, completely prevent the formation of mycorrhiza, even in cultures where the nitrate concentration was several times the highest known to occur naturally in Scandinavian forests. Shoot development in the Spruce seedlings was apparently unaffected by the addition of nitrate; in Pine seedlings, however, added nitrate generally had an adverse effect on shoot as well as mycorrhizal development.

While shoot development in both species was better at 49 than at 23 per cent. illumination, mycorrhizal development was equally good between 23 and 76 per cent. No mycorrhiza occurred at 6–8 per cent., and in Pine seedlings mycorrhiza was very sparse at as much as 12 per cent. Spruce seedlings under *Aegopodium* and *Scrophularia* averaged only 2 mycorrhiza per plant, as against 47 in the controls.

In Pine the percentage of mycorrhiza increased rapidly between 12 and 23 per cent. illumination from almost zero up to, or near, the maximal value. In Spruce, on the other hand, the main increase took place between 6 and 23 per cent. illumination, and as a rule more between 6 and 12 per cent. than between 12 and 23 per cent. illumination. In most soils the mycorrhizal percentage reached approximately maximal values at 23 per cent. illumination. Such values amounted to 60–90 per

cent., though for Spruce in garden soil the maximum percentage was below 60. Contrary to the mycorrhizal percentages, the number of mycorrhiza per seedling continued to rise up to 49 per cent. illumination, especially in Pine. Considering variation due to different illumination alone, a strong positive correlation existed between shoot weights and mycorrhizal numbers in both Pine and Spruce.

Pseudomycorrhiza occurred in high percentages in seedlings grown under less than 23 per cent. illumination, and since mycorrhiza did not develop in the most shaded cultures, probably all became pseudomycorrhiza under such conditions.

Experiments in which both nitrogen and light factors were varied showed that with high nitrate contents in the soil the mycorrhizal percentages rose more slowly with increasing illumination than when less nitrate was present. *From author's summary.*

11.43 : 13.1. FOURMAN, K. L. Lebensbedingungen und Verhaltensweisen der Bodenfauna forstlicher Standorte. **[Conditions of life and modes of behaviour of the soil fauna of forest habitats.]** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (160–8). [G.] [Waldbau-Institut 2 der Georg-August-Universität, Göttingen, in Hann.-Münden.]

11.43 : 22.11. DOBROGAEV, I. I. **Microbiology of forest soil in connexion with the formation of swamps.** *Pedology* 1939 (5), (78–88). [R.] S. & F. 3 (90).

After clearing the forest there was little microbiological activity owing to poor assimilation of the soil organic matter by bacteria.

11.46. Relationship of Plants to the Soil

11.46–7 : 11.42 : 21.3 : 12.2. MCCOMB, A. L., and KAPEL, F. J. **Growth of seedling Black Locust and Green Ash in relation to subsoil acidity and fertility.** *Abstract* of paper read at a meeting of the Society of American Foresters, Dec. 1939, in *J. For.* 38, 1940 (228). [Iowa State College.]

Planting experiments on an acid, infertile, glacial clay in southern Iowa showed that regardless of soil pH the seedlings of both species grew very poorly on unfertilized soil. The addition of nitrogen fertilizer alone had practically no effect on growth but the response to phosphorus fertilizer was tremendous, particularly for the Black Locust. Both species developed best at pH 4·3 with phosphorus treatment and at pH 6·9 without phosphorus.

11.46–7 : 11.44. AUTEN, J. T. **Reconstruction of the hardwood forest soil profile by vegetative covers.** *Abstract* of paper read at a meeting of the Society of American Foresters, Dec. 1939, in *J. For.* 38, 1940 (229). [Central States Forest Exp. Sta.]

Soil building should precede the establishment of the productive forest on abandoned land in order that soil moisture conditions may be improved. Conifers and so-called weed species may be used in building up a protective litter cover on dry sites. Investigations show that Pines and Sassafras greatly improve the rain-absorbing properties of the soil, while Black Locust is of little value as sod formation and the development of pasture conditions are characteristic under this species.

11.46 : 11.41 : 12.2 (43.9). VÁGI, I. **The physical properties of shifting sand soils in the Danube-Tisza Plain in relation to the planting of *Robinia*.** *Erdész. Lap.* 79, 1940 (23–8). [Hu.g.f.e.]

The relative proportion of fine to coarse sand appeared to have little influence on the success of *Robinia* planting as compared with the water régime of the soil.

11.46 : 11.48–9 : 12.19.2 (498). RUBȚOV, Ș. Solurile zăvoaielor Busăului, și tipurile naturale de arborete. **[Soils of the bottom lands of the Buzău river and the corresponding natural forest types.]** *Rev. Pădurilor* 52, 1940 (81–90). [Rum.f.]

As soils become more mature and inundations less frequent, with increasing elevation above river-level, the vegetation changes from *Tamaricetum* shrub to well-developed *Tamaricetum* stands, *Albo-Populetum-Tamaricetum* stands, pure *Albo-Populetum*, and finally to *Ulmetum-Albo-Populetum*.

11.46 : 11.6 : 21.2 (43.9). IJJASZ, E. L. Grundwasser und Baumvegetation unter besonderer Berücksichtigung der Verhältnisse in der Ungarischen Tiefebene. **[Ground water and tree vegetation, with particular reference to the Hungarian Plain.]** *Erdész. Kisérl.* 40, 1938 (159–269); 41, 1939 (1–116). [G.g.hu.]

The study is largely based on Hungarian research since 1920, including the author's own investigations. The main results are:—

Daily changes in the ground-water level are determined by rain, condensation, changes in

atmospheric pressure and temperature, wind, and the water consumption of vegetation. Atmospheric pressure and wind influence ground-water conditions only indirectly by disturbing the equilibrium of water vapour between atmospheric and soil air and thus furthering or hampering evaporation and condensation. The temperature of the ground water follows the same laws as the soil temperature in general, and is usually conditioned by the temperature of the soil layers in which ground water is found. Ground-water temperature is, therefore, generally somewhat lower under forest than in the open, except when the ground water is situated near the soil surface (not deeper than about 2 m.), in which case it is somewhat colder in summer and somewhat warmer in winter than in the open. The flow of water vapour in the soil has the effect of equalizing moisture distribution. The day flow and the summer flow are directed downwards, the night and the winter flow upwards. Owing to its geological and soil conditions, the Carpathian basin forms a hydrological unit, and ground-water conditions, at any particular place, are determined not only by local factors but also by the entire water régime of the basin. In its seasonal fluctuations, the ground water of the Plain occupies an intermediate position between the continental and the maritime ground-water types. With regard to tree vegetation, it may be said to be 'useful', since its quality and position are, on the whole, favourable to tree growth, especially between the Danube and the Tisza, where it is generally found at a depth of 2–3 m. The trees can make use of the entire capillary zone down to the very ground-water level, since even immediately above that level the soil still contains sufficient air. The wettest part of the capillary zone is not that in immediate contact with the ground water, but is found in a layer corresponding to 12–23 per cent. of the maximum capillary rise. In layered soils, the capillary rise is greatest and fastest where the structure of the soil becomes gradually finer towards the surface. The water-holding capacity of the soil helps the vegetation in utilizing ground water. When the level of the latter is lowered, part of the capillary water previously in contact with the ground water ('gebundene Kapillarwasser') is retained and thus remains accessible to vegetation. Of similar importance is the so-called 'sejunction water' (Engelhardt: *Soil Research, Berl.* Vol I, 1928–9) which remains in the layers previously filled with ground water after the latter has receded.

While mountain forests always have a 'conserving' effect on ground water, forests growing in the plain may lower or raise the ground-water level, as the case may be. Their effect depends on a great variety of factors and may alter within the same year, or from year to year, with meteorological conditions. The influence of forest is noticeable a short distance beyond the forest boundaries, especially in the direction of the flow of the ground water. Hungarian research has disposed of the conception that forests are capable of lowering the level of 'resting' ground water only—such water is very rarely met with in nature. In general, the *Robinia* forests of the Plain raise the ground water level to some extent. Root excavations showed that when trees do not find sufficient moisture in the upper layers of the soil, they attempt to reach the ground water with their roots. This applies equally to the relatively drought-resistant species such as *Robinia* and Austrian Pine. The root depths of the latter and of Scots Pine usually coincide with the average highest annual level of the ground water. The deepest roots of Scots Pine, Austrian Pine, Alder, Pedunculate Oak, White Poplar, and *Robinia* studied, were regularly flooded during the period of highest ground-water level, but did not appear to suffer from this circumstance. The study of ground-water conditions, and especially of the utilizability and chemical properties of the ground water, must form an integral part of every afforestation scheme in the Hungarian Plain.

11.46 : 12.19 : 23.3 (47.6). IL'INSKI, A. P. **Phytogeography and forest plantations in the steppe.** *Sovetsk. Bot.* 1939 (8), (57–64). [R.] [Botanical Institute of the Academy of Sciences of the U.S.S.R.] A.P.B.

Ecological observations in an experimental forest in the Voronezh region, where rainfall is less than 18 in. and soils are mainly chernozem and degraded chernozem, showed that an understorey of *Sambucus racemosa* lowered the diameter increment of Pine stands, impeded Pine regeneration, hastened the decomposition of litter, and increased slightly the acidity of the top soil. On the other hand, *Caragana arborescens* appeared to influence favourably the growth of the Pine overwood, and, contrary to the opinion of some local research workers,

C. arborescens regenerated freely under the cover of Pine.

11.47. Maintenance of Favourable Soil Conditions

11.47. WALLIHAN, E. F. **Factors affecting the response of forest vegetation to trenching.** *Abstract* of paper read at a meeting of the Society of American Foresters, Dec. 1939, in *J. For.* 38, 1940 (223–4). [Cornell University.]

Trenching resulted in an increase of available soil moisture and an increased absorption of nitrogen by the plants within the trenched plot.

11.47 (43.7). NĚMEC, A., and MAŘAN, B. **Results of experiments on the amelioration of sick forest soils in the Pilsen Basin.** *Lesnická Práce* 18, 1939 (507–39). [Cz.g.f.]

Results of 3 years' applications of basic slag (or dibasic calcium phosphate), calcium nitrate, and magnesium carbonate ('Magnesia Tatra') to strongly podsolized, heather-infested soils with a high content of soluble aluminium compounds. In some plots the fertilizing was combined with cultivation of perennial lupins. In spite of drought during the first half of the 3-year period, the 20-year-old stunted Pine plantations responded with better growth, and the chemical composition of both soil and needles has improved.

11.48-9. Kinds and Types of Soil

11.48–9 (59.1). EDWARDS, M. V. **The soil catena.** *Indian For.* 66, 1940 (10–14).

A soil catena is a 'chain' of soil types that vary mainly with topography, and are similar over fairly wide areas for the same topographic conditions. A brief description is given of the topography and resulting soil catenas of Pegu Yoma in Burma. Here the soil differences within a catena are indicated sometimes by changes in forest type but largely by differences in the Bamboo flora.

11.48–9 : 11.46 : 21.2 : 22 : 23. WILDE, S. A. **Classification of gley soils for the purpose of forest management and reforestation.** *Ecology* 21, 1940 (34–44). [Wisconsin Agricultural Exp. Sta.]

The proposed classification recognizes three ecologically important types of hydromorphous soils, based on the depth of the ground-water table or the upper limits of the gley horizon. (1) Alpha gley soils (shallow gley soils) or semi-swamp soils; gley layer protrudes through the A horizon at a depth of about 1 ft. from the surface. (2) Beta gley soils (mid-gley soils) or insufficiently drained, periodically wet soils: gley layer grades into B horizon, being 2 to 3 ft. from the surface. (3) Gamma gley soils (deep gley soils) or sufficiently drained but adequately moist soils: gley layer occurs in C horizon, at a depth of about 4 to 7 ft.

Alpha gley soils support stands of water-loving species, are characterized by a ground cover of mosses and sedges, and require drainage before planting. Heavy cutting may increase swamp conditions.

Beta gley soils are a transitional type suitable for the survival of both lowland and upland species, but not for their successful growth, as the latter suffer from deficiency of aeration in the spring and fall, and the former perish from drought in the summer. Root penetration is shallow and so there is a deficiency of available nutrients and a tendency for parasitic organisms to develop on weakened specimens. Shelterwood cutting is preferable in stands on this type. The characteristic ground cover consists of mesophytic and hydrophytic plants and numerous fern species.

Gamma gley soils are characterized by the occurrence of more exacting species than are ordinarily found on upland soils of similar texture. Sufficient depth of aerated soil, availability of nutrients, accessibility of ground water and its relatively small seasonal fluctuation result in exceptional rapid growth of stands and their general stability.

The workability of the proposed classification is illustrated by two concrete examples presenting the correlation between gley soils and forest growth in podsol and prairie-forest regions of Wisconsin. *From author's summary.*

11.6. *Hydrographical Conditions including Erosion*

11.6 : 07.7. COLLET, M. H. **A calibrated beam for use in gaging small streams.** *J. For.* 38, 1940 (66–8). [Southern Forest Exp. Sta.]

The description and illustration of a wooden beam to be used as an aid in making accurate and rapid measurements with a current meter.

11.6 : 07.7. ROWE, P. B. **The construction, operation, and use of the North Fork infiltrometer.** *Misc. Publ. Calif. For. & Range*

Exp. Sta. No. 1, 1940, pp. 64. [California Forest and Range Exp. Sta.]

Description of the North Fork infiltrometer, a portable apparatus developed primarily to determine the infiltration capacity of soils by sampling methods. Complete specifications for the manufacture of the apparatus and instructions for the sampling and operating procedure are given, together with data from actual field runs. The interpretation and application of infiltration measurements and the preparation of final reports are also discussed. The infiltrometer provides for a comparatively even distribution of simulated rainfall at intensities of from ¾ in. to more than 10 in. per hour, and affords a reliable means of measuring the infiltration capacity of soils under field conditions and of determining the influence of many of the factors affecting infiltration. The cost of the apparatus is about $175.

11.6 : 07.7. Scholz, H. F., and Stoeckeler, J. H. **A lysimeter installation for studying forest influence problems.** *J. For.* 38, 1940 (256–60). [Lake States Forest Exp. Sta.]

A detailed description of a set-up of 10 lysimeters which have been installed at the Upper Mississippi Valley Erosion Experiment Station for the study of the soil water phenomena and particularly the effect of vegetation on the water cycle. Each lysimeter, 20 ft. long, 10 ft. wide, and 4⅓ ft. deep, was located on a 10 per cent. slope and contained 90 blocks of soil weighing about 45,000 lb. Preliminary tests of the average amount of percolation water obtained from the lysimeters over a period of nine months indicate that the units give comparable results.

11.6 : 91. Okey, C. W. **Studies on the influence of forests on mountain streams.** *Civ. Engng., Easton, Pa.* 9, 1939 (744). [Tennessee Valley Authority.] L.S.

Brief criticism of a paper by R. A. Hertzler [*For. Abs.* 1 (233)]. The chief points made are (*a*) the studies must be continued over a longer period; (*b*) the peak rates of discharge quoted by Hertzler are based on catchment units of very different sizes; and (*c*) the recorded infiltration capacity of the forest soils is believed to be too high. It is suggested that a distinction should be made between the infiltration capacity of the litter layer and that of the soil proper, since water running on top of the soil under a bed of litter does not represent true infiltration.

12.1. *General Botany*

12.11. Physiology. Biology [including Genetics]

12.11. Boysen-Jensen, P. **Le rôle de l'auxine dans la croissance et les mouvements de croissance chez les plantes supérieures.** [**The rôle of auxin in the growth and growth movements of higher plants.**] *Scientia* 66, 1939 (233–40). [F.f.] L.S.

A general statement of the physiological effects of auxin.

12.11. Gouwentak, C. A., and Maas, A. L. Kambiumtätigkeit und Wuchsstoff. II. [**Cambial activity and growth substance. II.**] *Meded. LandbHoogesch. Wageningen* 44 (1), 1940 (1–16). [G.e.]

Shoots of *Fraxinus ornus*, *Populus nigra*, and *Salix fragilis* were completely disbudded. Cut surfaces were smeared with lanoline paste containing 100γ of heteroauxin or with lanoline only as controls. Spring treatment produced abundant growth of xylem along the whole length of the shoot; autumn treatment produced only local and incomplete growth. It is suggested that during the rest period not only the buds, but also the secondary meristems of the stem and branches are dormant. Thus there are two factors involved in the resumption of cambial activity, a growth-promoting substance and a factor breaking the rest period. Whether the second factor is also of the nature of a substance cannot yet be concluded. *From authors' summary.*

12.11. Melville, R. **Intergrading among plants in relation to the provenance of forest trees.** *Nature, Lond.* 145, 1940 (130–2). [Royal Botanic Gardens, Kew.]

Within the population of a species or species group, individual characters may show considerable variation under different conditions of climate, topography, &c. Where information is available or intensive study possible, particular characters or groups of associated characters should be intergraded between the observed extremes, and the individuals of the specific population arranged accordingly. The term suggested for such a graded series is *cline*, prefixed to denote a particular type such as topocline, geocline, &c. One example cited is the Cedars, which when arranged in geographical order, form a graded series with leaves increasing in length from west to east and the number of leaves in each yearly fascicle on the short

shoots decreasing in the same order. The intermediate forms in a hybrid population may also be arranged in graded sequence.

12.11 : 12.2 (7). JOHNSON, L. P. V. **A descriptive list of natural and artificial interspecific hybrids in North American forest-tree genera.** *Canad. J. Res.* 17, 1939 (411–44). [Division of Biology and Agriculture, National Research Laboratories, Ottawa.]

Over 400 hybrids involving 28 North American genera of forest trees are described in tabular form. The genera involved are: *Abies, Acer, Aesculus, Alnus, Arbutus, Betula, Carya, Castanea, Catalpa, Cornus, Crataegus, Cupressus, Gleditsia, Ilex, Juglans, Larix, Magnolia, Picea, Pinus, Platanus, Populus, Quercus, Robinia, Salix, Taxus, Tilia, Tsuga,* and *Ulmus. From author's summary.*

12.11 : 12.2. LANGLET, O. Om utvecklingen av granar ur frö efter självbefruktning och efter fri vindpollinering. **[On the development of Spruce from seed of self-pollinated cones and cones subject to free wind pollination.]** *Medd. Skogsförsöksanst. Stockh.* 32, 1940 (1–22). [Sw.g.]

In 1909 Nils Sylvén artificially self-pollinated a number of cones on 5 Spruce trees and obtained viable seed. At the same time seed was collected from other cones, on the same trees, exposed to free wind pollination. Seedlings were raised in 1910 and planted out in 1916. Since that date 25 per cent. of the seedlings from selfed cones have succumbed and 25 per cent. show injury. All of the plants from cones exposed to wind pollination are still alive and only 12 per cent. have been injured. Both the mean height and the mean d.b.h. of the trees derived from selfed cones are less than half those of the trees from naturally pollinated cones. Some of the former show irregular branching, and one tree has an irregular needle arrangement. Details are also given of the growth and type of cone scale of the parents as compared with those of the progeny.

12.11 : 12.15 : 12.2. DENGLER, A. Über die Befruchtungsfähigkeit der weiblichen Kiefernblüte. **[On the capacity for fertilization of the female Pine flower.]** *Z. Forst- u. Jagdw.* 72, 1940 (48–54). [G.] [Waldbau-Institut der Forstlichen Hochschule Eberswalde.]

Fertilization experiments during two seasons on the same tree showed that the duration of the capacity for fertilization was 9–11 days. The female flowers were capable of fertilization shortly before the male flowers disseminated their pollen; thus there was no evidence of protandry.

12.11 : 12.15 : 12.2 (485). LINDQUIST, B. Tallens roll i svensk skogsträdsförädling. **[The rôle of Pine in Swedish forest tree-breeding.]** *Tidsskr. Skogbr.* 48, 1940 (10–7, 40–6). [Sw.]

There are two main races of *Pinus sylvestris* in Sweden: a narrow-crowned race that predominates in the north and a broad-crowned race occurring more commonly in the south. From the point of view of utilization the narrow-crowned race is the more valuable as it is comparatively free from knots and yields a larger quantity of higher-grade timber and pulpwood logs. Although the increment of the two types has not been compared in detail, there is evidence to suggest that while the broad-crowned trees grow faster in youth, the narrow-crowned may catch up and put on more increment in the later stages of development. Use of the narrow-crowned race should permit a larger number of stems per unit area to reach timber size without forcing self-pruning too far or hampering crown development. In 1938 the Forest Tree-Breeding Association, the Central Council of the County Forestry Boards, and the State Forest Service, began a survey of existing stands of Pine in five counties in order to locate suitable sources for certified seed. This survey is now almost complete and will be extended to cover the whole country. Narrow-crowned trees are recognized as the most desirable, and the highest grade of certified seed will be that from pure narrow-crowned stock. Efforts are also being made to encourage the selective treatment of stands to favour the regeneration of this type of tree. In addition to the above work, breeding experiments were started by the author in 1934, and the Forest Tree-Breeding Association is now actively engaged in breeding work.

12.11 : 12.2. FOUARGE, J. Note sur la caryocinèse chez les chênes pédonculé et rouvre. **[Note on nuclear division in the Pedunculate and Sessile Oaks.]** *Bull. Inst. agron. Gembloux* 8, 1939 (111–3). [F.flem.g.e.] L.S.

The chromosome numbers for both *Quercus robur* L. (*Q. pedunculata* Ehrh.) and *Q. sessilis* Ehrh. (*Q. sessiliflora* Salisb.) were $n = 12$, $2n = 24$. Both species had chromosomes of identical shape and size.

12.11 : 21.2 : 31.1. ROUSCHAL, E. Die kühlende Wirkung des Transpirationsstromes in Bäumen. **[The cooling effect of the transpiration stream in trees.]** *Ber. dtsch. bot. Ges.* 57, 1939 (53–66). [G.g.] O.B.D.

An investigation of the thermal effects of the transpiration steam in various broadleaved and coniferous trees. The cooling effect of the rising transpiration stream was shown to be greater in ring-porous woods, which permit free upward movement of water, than in diffuse-porous and coniferous species. In ring-porous species in direct sunlight the temperatures of the outer bark and the water-conducting xylem differed in roots by 5° C. (*Quercus*) to 15° C. (*Castanea*) and in stems by about 3½° C. The differences diminished gradually with height in the stem but were still detectable at a height of 3 m. In diffuse-porous species and conifers the temperature difference in the roots was only about 1° C., this difference persisting to a height of 1 m. in the stem but disappearing before the 3 m. level. No special biological significance is attributed to these phenomena.

12.11 : 21.2. GIBBS, R. D. **Studies in tree physiology. I. General introduction. Water contents of certain Canadian trees.** *Canad. J. Res.* 17, 1939 (460–82). [Department of Botany, McGill University, Montreal.] P.R.

In *Betula alba* var. *papyrifera*, *B. alba* var. *pendula laciniata*, *B. populifolia*, and *Populus tremuloides* there is a marked seasonal rhythm in the water content of the trees, the maximum occurring at leaf opening and the minimum at leaf fall. In general, the water content is high during the winter and low during the summer. *P. tremuloides* rapidly achieves a very high water content after leaf fall, the tree being practically full of water in December, but the Birches return more slowly to the maximum water content. Distinct losses of water occur in these species during the winter, particularly in the period between midwinter and leaf opening. *Pinus banksiana*, *Picea canadensis*, and *Abies balsamea* gave little indication of seasonal change, but further work may reveal slight variations. In *Tsuga canadensis*, however, the sapwood is subject to a clear seasonal rhythm resembling that of the Birches and Aspen, though the wood as a whole varies little, owing to the high proportion of heartwood. The wood, twigs, and leaves of various softwoods also show variable winter water losses, but further investigation of this point is necessary. Losses from leaves are said to be surprisingly small. The water régime of *Betula populifolia* has been studied for more than 3 years and an attempt is being made to correlate its behaviour with weather conditions; this work is not yet completed. The influence of seasonal variation in the water content of logs upon ease of floating and land transport is stressed.

12.11 : 12.2. GIBBS, R. D. **Studies in tree physiology. II. Seasonal changes in the food reserves of Field Birch (*Betula populifolia* Marsh.).** *Canad. J. Res.* 18, Sec. C, 1940 (1–9). [Department of Botany, McGill University, Montreal.] P.R.

During the period January 1936 to July 1938, the upper parts of *Betula populifolia* Marsh. were analysed for water, reducing sugars, sucrose, total soluble sugars, ether-soluble material, polysaccharide hydrolysable by taka-diastase, and residual polysaccharides extracted by dilute acid. From 38 to 63 per cent. of the taka-diastase hydrolysate from the wood is non-fermentable, presumably pentose. The residual acid extract is from 69 to 100 per cent. non-fermentable. Hexosan is low in winter, rises to a maximum just before leaf-opening, decreases sharply during spring growth and accumulates in summer. Ether-soluble material is not stored in winter. Sucrose and to a lesser extent reducing sugars are high in winter. There is a significant correlation between reducing sugars and water content of twigs. Food reserves of the cortex behave much as do those of wood. *Author's summary.*

12.11 : 12.2. GORYACHENKOVA, E. V., and ZOLOTAREV, E. Kh. **Changes in the biochemical properties of the Oak leaf in the course of the vegetation period.** *Dokl. vsesoyuz. Akad. s.-kh. Nauk* No. 17, 1939 (20–5). [R.] A.P.B.

12.12. Pathology

12.12 : 12.2. SCHNELL, R. Observations sur deux 'balais de sorcière' de l'épicéa. **[Observations on two witches' brooms on Spruce.]** *Bull. Soc. bot. Fr.* 86, 1939 (318–23). [F.] L.S.

A description of the morphological features of two witches' brooms on Spruce, one from the Vosges and one from the Jura. The deformity is very rare; it consists chiefly in increased branchiness combined with much

shortened internodes, giving the affected branch system a massive globular form. Von Tubeuf believes the cause to be a bud mutation.

12.12 : 12.2 (73). SWINGLE, R. U. **Phloem necrosis in the Ohio River Valley.** [*Abstract* of paper read at the 31st annual meeting of the American Phytopathological Society.] *Phytopathology* 30, 1940 (23).

The disease has now been found in Ohio, Indiana, Illinois, Missouri, Tennessee, Kentucky, and West Virginia. Artificial transmission has been achieved only by grafting. Both chronic and acute cases of disease are known to exist. Two trees that showed typical symptoms in previous years exhibited a marked degree of recovery in the past season; seedlings from one of these, though failing to develop the disease, were very variable and in some cases had mottled foliage. Attempts to cure diseased trees by supplying nutrients have been unsuccessful.

12.12 : 12.2 (75.4 : 76.9). LEACH, J. G., and VALLEAU, W. D. **Two reports on phloem necrosis of Elm.** *Plant Dis. Reptr.* 23 (18), 1939 (300–1). R.A.M. 19 (172).

Notes on the status of the disease in West Virginia and Kentucky.

12.12 : 12.2 : 31.42 (73). LONG, W. H. **Two pocket rots of hardwood trees.** *Bull. Torrey bot. Cl.* 66, 1939 (625–7). O.B.D.

A white pocket heart rot at the base of living trees of *Exothea paniculata*, *Lysiloma bahamensis*, and *Taxodium distichum* in Florida is caused by *Fomes extensus*. Logs and stumps of *Liquidambar styraciflua* in the Mississippi valley are subject to attack by *Polyporus rigidus*, which causes a characteristic honeycomb rot. Fallen trees of *Nyssa sylvatica*, *Platanus occidentalis* and *Quercus alba* have been similarly but less conspicuously attacked by the latter fungus.

12.12 : 12.2 (74). CAMPBELL, W. A., and DAVIDSON, R. W. **Sterile conks of *Polyporus glomeratus* and associated cankers on Beech and Red Maple.** *Mycologia* 31, 1939 (606–11). R.A.M. 19 (125–6).

Sterile conks of *Polyporus glomeratus*, with or without associated cankers, were common in 1938 on Beech in the Green Mountain National Forest, Vermont, and were also found in New Hampshire, Pennsylvania, and Maine. They frequently formed at old, unhealed branch stubs and in time a trunk canker developed above the stub. On old trees the cankers were often as much as 2 ft. long. *P. glomeratus* seldom fruits on living trees but sporophores develop on fallen logs after several years. The fungus was also associated with cankers on *Acer rubrum* in New Hampshire and Vermont (less commonly in Connecticut and Pennsylvania), particularly in connexion with old branch stubs. It is evidently an important agent of decay of Red Maple and has also been collected on Sugar Maple (*A. saccharum*) in Maine.

12.12 : 12.2 (77.4–6). LORENZ, R. C., and DAVIDSON, R. W. **Observations on several diseases of hardwoods in the Lake States.** *Plant Dis. Reptr.* 23, 1939 (384–5). R.A.M. 19 (243–4).

Butt and trunk rot of *Fraxinus nigra* was caused by *Fomes conchatus* in Wisconsin, Michigan, and Minnesota, and in the latter State *Ulmus americana* was attacked by *Schizoxylon microsporum*, while *Eutypella parasitica* was apparently the cause of canker on *Acer negundo*.

12.12 : 11 : 12.2. HEIMBURGER, C., and MCCALLUM, A. W. **Balsam Fir butt rot in relation to some site factors.** *Woodlands Rev.* 11 (4), 1940 (9–11). [Dominion Forest Service, & Division of Botany & Plant Pathology, Department of Agriculture.]

A study of the frequency and intensity of several forms of butt rot in Balsam Fir and in Spruce was undertaken for two distinct site-types in an area of the Boreal Forest Region in Quebec. The two site types differ in respect to ground vegetation, physiography, stand composition, i.e. softwood flats (*Cornus* type) as contrasted with mixedwood slopes (*Aster* type), and certain soil characteristics. The frequency and intensity of butt rot in Balsam Fir were found to be greater on the *Aster* type, a relatively dry local condition, and on areas with a high proportion of hardwoods in the stand. It is recognized that forest regions having a cool, moist climate are well known to possess relatively sound Balsam Fir, and it is suggested that local differences in soil moisture as reflected by site-types may similarly have an effect on butt rot in this species. *From authors' summary.*

12.12 : 12.2 (78.9 : 79.1). ELLIS, D. E. **Conifer diseases hitherto unreported from the southwest.** *Plant Dis. Reptr.* 23, 1939 (341). R.A.M. 19 (248).

The paper reports:—*Rhabdocline pseudotsugae* on Douglas Fir in Arizona, associated in the early stages with an imperfect fungus resembling *Rhabdogloeum pseudotsugae*; *Elytroderma deformans* on *Pinus edulis* and *P. ponderosa* in Arizona, frequently producing witches' brooms on both hosts; and a canker of *P. ponderosa* very similar to that attributed to *Cenangium piniphilum* and apparently caused by a closely related fungus, in Arizona and New Mexico.

12.12 : 12.2 (79.7). BUCHANAN, T. S. **Fungi causing decay in windthrown northwest conifers.** *J. For.* 38, 1940 (276–81). [Division of Forest Pathology, Bureau of Plant Industry.]

An evaluation of the fungi found over a period of fifteen years on timber that was blown down on the Olympic Peninsula of Washington in 1921. Tree species examined included *Pseudotsuga taxifolia*, *Picea sitchensis*, *Tsuga heterophylla*, *Abies amabilis*, and *Thuja plicata*. Sporophores of 21 wood-destroying fungi were found during the period, and of these fungi 17 had caused appreciable decay, 13 acting as scavengers, 2 commonly occurring on living trees, and 2 causing root rot. Persistence and distribution of sporophores was not constant over the fifteen-year period, and incidence and distribution of sporophores was not found to be a wholly reliable index of the presence or amount of decay in wind-thrown timber. By 1936 decays caused by *Fomes pinicola* and *F. applanatus* were found in more than 85 per cent. of the decayed volume of Sitka Spruce and Douglas Fir.

12.12 : 12.2 (68). STEPHENS, R. P., and GOLDSCHMIDT, W. B. **A preliminary report on some aspects of Wattle pathology.** *J. S. Afr. For. Ass.* 2, 1939 (31–43).

The diseases of Wattle plantations in South Africa, known as gummosis, the Albert Falls disease, root collar rot, 'frog-hopper' and one or two others are described. The present knowledge of these diseases is summarized and future measures of control are discussed.

12.12 : 12.2. PIRONE, P. P. ***Phytophthora* disease of Maples.** [*Abstract* of paper read at the 31st annual meeting of the American Phytopathological Society.] *Phytopathology* 30, 1940 (19).

In New Jersey hundreds of Maples, particularly *Acer platanoides*, have died as a result of attack by a fungus of the *Phytophthora cambivora* group. Symptoms were a thin crown due to a decrease in the number and size of the leaves, and cankers at the base of the trunk near the soil line. The trees die when the cankers completely girdle the trunk. Under experimental conditions, infection took place only when the trees were wounded just before inoculation.

12.12 : 12.11 : 12.2. KELLEY, A. P. **The Chestnut blight and its relation to the principle of disease resistance.** *Science* 91, 1940 (290–1).

12.12 : 12.2. **A blight resistant Chestnut.** *Sci. Amer.* 161, 1939 (93). Pl. Breeding Abs. 10 (308).

A hybrid resistant to *Endothia parasitica* and possessing a nut similar to its American parent has been selected at the Bartlett Tree Research Laboratories, United States, from a cross between an American Chestnut and *Castanea mollissima*, from China.

12.12 : 12.2 (729.5). GARCÍA, L. A. ALVAREZ. **A Cedar seedling blight in Puerto Rico.** *Carib. For.* 1 (2), 1940 (26). [E. span.] [Agricultural Exp. Sta., Rio Piedras, Puerto Rico.]

Seedlings of *Cedrela mexicana* Roem. were attacked by the fungus *Phyllachora balansae* Speg., which caused severe defoliation and in many cases killed the trees. The lesions caused by the fungus are described; they occur chiefly on the leaf blades, but also on the petioles and young twigs.

12.12 : 12.2. KNUCHEL, H. Merkwürdige Krankheit an einer Esche. [**A noteworthy disease of an Ash.**] *Schweiz. Z. Forstw.* 91, 1940 (36–7). [G.]

The disease has not been definitely identified, although the cross-section of a diseased Ash observed in the Aargau Canton resembled cross-sections of *Abies alba* and *Picea excelsa* attacked by *Pleurotus mitis* (Pers.) Fr.

12.12 : 27 : 12.2 (494). BRUGGISSER. Die reinen Fichtenbestände im fünften aargauischen Forstkreise. [**The pure Spruce stands of the Fifth Aargau Forest District.**] *Schweiz. Z. Forstw.* 91, 1940 (64–70). [G.]

Agricultural utilization of the soil for many years in the middle of the last century is considered the primary cause of root rot in some of the pure Spruce plantations of the region.

12.12 : 12.2. ZEROVA, M. Ya. **A Spruce disease caused by the fungus *Phomopsis***

***piceae* Zerova sp. nov.** *Zh. Inst. bot. Akad. Nauk U.R.S.R.* No. 20 (28), 1939 (137–43). [Ukr.r.e.] A.P.B.

Die-back of 5- to 8-year-old Norway Spruce (*Picea excelsa*), preceded by yellowing and shedding of the needles and shrivelling of the branches, occurred in a nursery near Kiev in 1936–7. Isolations from the infected material constantly yielded a fungus described as *Phomopsis piceae* n. sp. Other fungi were present, but *P. piceae* is believed to be the cause of the disease, although preliminary inoculations gave negative results.

12.12 : 12.2. RIEBEN, E. Un ennemi des forêts de montagne: *Usnea barbata.* [***U. barbata*: an enemy of mountain forests.**] *J. for. suisse* 91, 1940 (62–4). [F.]

Etiolation of entire Spruce stands, including relatively young trees, was observed at 1,500 m. elevation in the Joux-des-Vents forests near Leysin as a result of infestation by *U. barbata*. The lichen almost completely prevented the access of light and air to the needles.

12.12 : 23 : 12.2. YORK, H. H. **Relative susceptibility of young Pine trees in artificial and natural stands to invasion by fungi and bacteria.** [*Abstract* of paper read at the 31st annual meeting of the American Phytopathological Society.] *Phytopathology* 30, 1940 (28).

Investigations over a period of 10 years of stands of White, Red, and Scots Pine indicate a definite relation between the way in which trees are set in the ground and their susceptibility to fungi and bacteria that invade the root crown. So far, trees raised by natural seeding have proved far less susceptible to infection.

12.12 : 12.2. KIMMEY, J. W. **Time of growth of *Cronartium ribicola* cankers on *Pinus monticola* at Rhododendron, Oregon.** *Phytopathology* 30, 1940 (80–5). [Branch Office of the Division of Forest Pathology, Bureau of Plant Industry, Portland, Oregon.]

About 90 per cent. of the canker growth takes place from April to November and during this period it is rapid. Temperature is thought to be one of the factors determining the period of rapid growth. Probable indicators of the time of acceleration and retardation of canker growth are, respectively, the breaking of the buds, and the leaf-cast of deciduous trees.

12.12 : 12.2. BUCHANAN, T. S. **Needle-bearing internodes on Western White Pine reproduction in relation to blister-rust infection.** *J. For.* 38, 1940 (52–4). [Division of Pathology, Bureau of Plant Industry.]

It has been established that the current season's shoots of Western White Pine are relatively resistant to infection by blister rust and it is believed that this resistance is a characteristic of the needles on that year's growth. This study was undertaken to obtain some idea of the usual relation between the blister-rust target exposed on the current season's growth and on older growth still bearing needles. Among other things it was found that, for trees 5 to 19 years old, the usual ratio between the blister-rust target presented by the current year's growth and that presented by the growth of the year previous was 1·5 : 1·0.

12.12 : 12.2. WALTER, J. M., and MOOK, P. V. **New facts concerning the Plane disease.** [*Abstract* of paper read at the 31st annual meeting of the American Phytopathological Society.] *Phytopathology* 30, 1940 (27).

Plane trees in the western United States have been killed by a disease due to a species of *Ceratostomella*, the pathogenicity of which has been proved by inoculations. Infection occurs both in trunks and in branches in the crown. Many branch infections were associated with pruning cuts, and the disease has been transmitted experimentally with pruning saws.

12.12 : 12.2. CHORIN, M. ***Cytospora chrysosperma* on *Populus nigra*.** *Palest. J. Bot., R. Ser.* 2, 1939 (251–88). R.A.M. 19 (171).

This fungus caused yellowing and defoliation of Poplars (*Populus nigra*) at Tell Aviv, Palestine, in 1939.

12.12 : 12.2 (74.6). MCCORMICK, F. A. ***Phaeocryptopus gaeumanni* on Douglas Fir in Connecticut.** *Plant Dis. Reptr.* 23, 1939 (368–9). R.A.M. 19 (247–8).

In January 1938 Douglas Fir at East Willington, Connecticut, was found to be infected with *P. gaeumanni* [*For. Abs.* 1 (69–71, 142)]. The fungus was later discovered on a collection of Douglas Fir needles, dated 1929, from Salisbury, Connecticut. A visit to the latter locality in 1939 showed that the infected trees were badly diseased or almost dead. Other Connecticut localities are now known and it would appear that the fungus is widespread in the north of the State, though not yet found in the south.

12.12 : 12.2. TYLER, L. J., PARKER, K. G., and POPE, S. **Relation of wounds to infection of American Elm by *Ceratostomella ulmi*, and the occurrence of spores in rainwater.** *Phytopathology* 30, 1940 (29–41). [Department of Plant Pathology, Cornell University, Ithaca, N.Y.]

In laboratory experiments, *Ceratostomella ulmi* spores were easily dislodged from fruiting structures by means of a water spray, but not by dry air currents. Rain water from 9 out of a total of 32 diseased field Elms yielded *Ceratostomella ulmi*.

Infection of potted American Elms was easily obtained by introducing *Ceratostomella ulmi* spores into fresh wounds extending into the wood of roots, trunks, and branches, and by applying inoculum to the surface of freshly exposed but uninjured wood. Occasional and slight infection was obtained by introducing spores into leaf traces, and into injuries on leaf midribs and succulent parts of newly formed or forming shoots. Infection did not result from applying spores to non-wounded surfaces, or from introducing spores into cortical wounds that did not reach the wood. Age and healing of wounds had a marked effect upon the entrance of *Ceratostomella ulmi*.

Potted trees, inoculated at any time within their active growth period, were extensively invaded. Trees inoculated before this period frequently became infected, but invasion usually was slight. Trees inoculated after this period usually became infected and some were extensively invaded.

Infection occurred more frequently in trees inoculated through wounds on above-ground parts, which were held under relatively high moisture conditions. *From authors' summary.*

12.12 : 12.2. TRUE, R. P., and SLOWATA, S. S. **Attempts to isolate *Ceratostomella ulmi* from stored Elm wood.** *Phytopathology* 30, 1940 (272–4). [Division of Forest Pathology, Bureau of Plant Industry.]

After 4 months' storage under a number of conditions, only a part of the diseased sticks yielded the fungus, and after 20 months *C. ulmi* was isolated from only a small percentage of all sticks.

12.12 : 12.2 (47.4). LEPIK, E. **Estonia. The Elm disease in the country.** *Int. Bull. Pl. Prot.* 14 (1), 1940 (2). R.A.M. 19 (311).

Ceratostomella ulmi has now been observed in eleven districts throughout the country, causing extensive wilting.

12.12 : 12.2 (73). **Present status of the Dutch Elm disease.** *Plant Dis. Reptr.* 23, 1939 (286–8). R.A.M. 19 (124).

Present distribution of the disease in the United States.

12.12 : 12.2 : 13.2. LEACH, J. G. **Fungi associated with *Scolytus multistriatus* in regions where *Ceratostomella ulmi* has not been found.** [*Abstract* of paper read at the 31st annual meeting of the American Phytopathological Society.] *Phytopathology* 30, 1940 (15).

Fungi found to be consistently associated with *Scolytus multistriatus* in south-western West Virginia were *Graphium* sp., *Penicillium* sp., *Fusarium* sp., and one or more species of yeast. These are believed to exert a favourable influence upon the larval environment of the beetle. The beetle is multiplying rapidly in trees killed by phloem necrosis in this region, and the existing conditions will favour the rapid spread of Dutch Elm disease if *Ceratostomella* should appear.

12.12 : 12.2 : 13.2 (492). FRANSEN, J. J. De smakelijkheid van verschillende soorten iepen voor de iepenspintkevers. **[The attractiveness of various Elms to the Elm bark beetles.]** *Landbouwk. Tijdschr.* 51, 1939 (435–523). [Du.g.] R.A.E. A28 (116).

In Holland, *Ophiostoma* (*Ceratostomella*) *ulmi* is transmitted only by *Scolytus scolytus* F. and *S. multistriatus* Marsh. The present paper reviews investigations on the susceptibility of various Elms to infection by injected spores of the fungus and discusses factors influencing the attractiveness of Elms to the beetles for maturation feeding. Observations showed that both species of bettle feed on healthy Elms, and that *S. scolytus* also readily attacks trees infected by the fungus. It is concluded that probably all species and varieties of *Ulmus* are acceptable to the beetles for maturation feeding. *U. pumila* was fed on by the greatest number of beetles, but was resistant to the fungus.

12.12 : 13.1 : 12.2 : 13.2. LEACH, J. G., HODSON, A. C., CHILTON, ST. J. P., and CHRISTENSEN, C. M. **Observations on two ambrosia beetles and their associated fungi.** *Phytopathology* 30, 1940 (227–36). [Minnesota Agricultural Exp. Sta.]

Description of *Trypodendron retusum* Sw. and *T. betulae* Sec. affecting Aspen and Birch, respectively, and their associated ambrosia fungi.

12.12 : 13.2. ESCHERICH, K. Die Waldheuschrecke (*Barbitistes constrictus* Br.) als Forstschädling. [**The wood grasshopper (*B. constrictus*) as a forest pest.**] *Anz. Schädlingsk.* 16, 1940 (1–2). [G.]

This insect prefers needles but feeds also on broadleaved foliage, grass, heather, &c. Kozikowski reported serious damage to 200 ha. of Polish Pine plantations during 1925–7. *B. constrictus* attacks frequently coincide with those of *Lymantria monacha*.

12.12 : 12.2 : 13.2 (41.1–4). CAMERON, A. E. **Insect and other pests of 1938.** *Trans. Highl. agric. Soc. Scot.* 1939. pp. 40. (Repr.) R.A.E. A28 (131–2).

Sawfly larvae defoliating 10-year-old *Alnus incana* in southern Scotland were identified as *Camponiscus luridiventris* Fall., *Croesus septentrionalis* L., *Nematus pavidus* Lep., and *Nematinus luteus* Panz. They were active only late in the season and damage to the trees was slight. Galls of *Rhyacionia resinella* L. were found in considerable numbers on *Pinus sylvestris* near Edinburgh.

12.12 : 13.1 (729.5). MARTORELL, L. F. **Some notes on forest entomology.** *Carib. For.* 1 (2), 1940 (31–2). [E. span.] [Agricultural Exp. Sta., Rio Piedras, Puerto Rico.]

Plantations of *Cassia siamea* Lam. have suffered heavy attacks throughout Puerto Rico, and especially on the coastal plains, by the pustule scale, *Asterolecanium pustulans* Cockerell, to which the trees eventually succumb. Other hosts of the scale are *Grevillea robusta* Cunn. and *Nerium oleander* L.

The West Indian peach scale, *Aulacaspis pentagona* Targioni, has attacked trees of *Fraxinus* imported by the Forest Service. Heavily infested trees were completely defoliated and exhibited a kind of die-back which killed many of them.

Several trees of Moralon, *Coccolobis grandifolia* Jacq., were almost completely defoliated by the sawfly *Sterictiphora zaddachi* Dewitz which normally infests the Sea-Grape, *Coccolobis uvifera* (L.) Jacq. Infestation of the latter was found to be heaviest on sites protected from the full force of the wind.

12.12 : 12.2 (79.2). LEON, D. DE. **An outbreak of a needleminer, *Epinotia meritana*, in White Fir.** *Pan-Pacif. Ent.* 15, 1939 (89–90). I.I.E.

A severe, localized outbreak of *Epinotia meritana* Heinrich was found in 1937 on *Abies concolor* (Gordon) Parry in Utah. The species had previously been known only from Pine in Utah and British Columbia. In the present instance trees of White Fir had apparently been subject to defoliation for 4 or 5 years and many were practically dead. Although all age classes were infested, trees of middle age suffered the heaviest defoliation. Notes are included on the characters and life history of the moth.

12.12 : 12.2 : 13.2 (43.6). BRAMSTEDT, F. *Börnerina*, eine neue Gattung der Atheroididen (Chaetophoriden). [***Börnerina*, a new genus of the Atheroididae (Chaetophoridae).**] *Anz. Schädlingsk.* 16, 1940 (13). [G.]

Description of *Börnerina depressa*, a new genus and species of aphid found on *Alnus viridis* in Austria.

12.12 : 12.2 (560). SCHIMITSCHEK, E. Über einige Schädlinge der Haselkulturen. [**Some pests of Hazel plantations.**] *Z. angew. Ent.* 26, 1939 (449–61). [G.]

12.12 : 12.2 : 13.2. GÄBLER, H. *Lophyrus rufus* Retz. = *sertifer* Geoffr. an Bergkiefer und Fichte. [***L. rufus* (*sertifer*) on Mountain Pine and Spruce.**] *Anz. Schädlingsk.* 16, 1940 (22–3). [G.]

During an outbreak of *Lophyrus rufus* on Mountain Pine in the Erzgebirge in 1939, neighbouring trees of Norway Spruce were also damaged. The larvae were previously believed to feed only on species of Pine.

12.12 : 12.2 : 13.2 (78.6). EVENDEN, J. C., and GIBSON, A. L. **A destructive infestation in Lodgepole Pine stands by the Mountain Pine beetle.** *J. For.* 38, 1940 (271–5). [Bureau of Entomology & Plant Quarantine.]

During the decade 1927–36 an outbreak of the Mountain Pine beetle (*Dendroctonus monticolae*) spread through an area of 1,341,860 acres of the Beaverhead National Park in Montana, killing approximately 57,756,000 trees above 3 in. d.b.h. It is estimated that 77·3 per cent. of the original merchantable stand 9 in. d.b.h. and over was lost. Probably the most important of the secondary bark

beetles associated with *D. monticolae* in this outbreak was *Pityogenes knechteli*. A marked decrease in the infestation in 1933 and again in 1935 was due primarily to unseasonably low temperatures which caused considerable mortality in overwintering broods.

12.12 : 12.2 : 13.2 (44). DUCASSE, G. Quelques observations sur une cochenille: *Matsucoccus matsumurae* Kuwana. **[Some observations on a coccid, *M. matsumurae* Kuw.]** *Rev. Zool. agric.* 37,.1938 (129–33). [F.] R.A.E. A28 (118).

M. matsumurae Kuw. was first observed in France in 1935, occurring on *Pinus pinaster* (*maritima*) in the south-west. Fresh localities have since been found and a study has been made of its bionomics. So far it has been found only on large trees, causing little damage.

12.12 : 12.2 : 13.2. BENSON, R. B. **On the biology of the sawfly *Xyela julii* Brebisson (Hym., Symphyta).** *Ent. mon. Mag.* 76, 1940 (35–6).

A dead female *Xyela julii* was found with ovipositor inserted in a male cone of *Pinus sylvestris*. A whitish larva which emerged from this cone or one nearby agreed exactly with the description of a larva of the North American *X. minor* which feeds on the staminate cones of Pine, and later, before the cones blossom, drops to the ground and forms subterranean cells. It is shown that *X. julii* does not necessarily go underground to form a cocoon.

12.12 : 12.2 : 13.2 (43.1–5). SCHWERDTFEGER, F. Ein neuer Feind der Douglasie? **[A new pest of Douglas Fir?]** *Dtsch. Forstw.* 1939 (49). pp. 2. Repr. R.A.E. A.28 (41).

Infestation of *Pseudotsuga taxifolia* by *Chermes* (*Gilletteëlla*) *cooleyi* Gill. occurs in widely separated localities in Germany, though its economic importance is uncertain. The distribution and life cycle of the insect are discussed.

12.12 : 12.2 : 13.2 (489). THOMSEN, M. Douglasgranlusen (*Chermes cooleyi*) i Danmark. **[The Douglas Fir chermes (*C. cooleyi*) in Denmark.]** *Dansk Skovforen. Tidsskr.* 1940 (93–109). [Da.]

Chermes (*Gilletteëlla*) *cooleyi* was first observed in Denmark on *Pseudotsuga douglasii* at Langesø, Fynen, in September 1938. The attack was of light to medium intensity. Trees of all ages were attacked, but the aphids were less frequent on older trees. Galls were also found on *Picea sitchensis* in the same district. In 1939 the attack was apparently less intense than in the previous year. Fresh galls were again found on *Picea sitchensis* and also on *Abies alba*. The damage done by the aphid is as yet of no practical importance.

12.12 : 23.23.1 : 12.2 : 13.2. OUDEMANS, T. C. *Megastigmus spermotrophus* Wachtl, een gevaarlijk vernieler van het zaad van *Pseudotsuga douglasii* Carr. **[*M. spermotrophus*, a dangerous pest of seed of *P. douglasii*.]** *Ned. Boschb.-Tidjschr.* 13, 1940 (41–8). [Du.]

12.12 : 23.23.1 : 12.2 : 13.2. OUDEMANS, T. C. Bestrijding van *Megastigmus spermotrophus* Wachtl in het zaad van *Pseudotsuga douglasii* Carr. **[Control of *M. spermotrophus* in seed of *P. douglasii*.]** *Ned. Boschb.-Tijdschr.* 13, 1940 (215–7). [Du.]

In tests made by the Dutch Plant Disease Service [Plantenziektenkundige Dienst] and the State Seed-testing Station [Rijksproefstation voor Zaadcontrôle] on Douglas Fir seeds infested with larvae of *Megastigmus spermotrophus*, satisfactory control was achieved, without impairing the germinative capacity of the seeds, by treatment with either carbon disulphide vapour or 'Areginal' vapour at 250 c.c. per cu.m. for 24 hours. Carbon tetrachloride was less toxic to the larvae and its use resulted in lower germination figures. Preliminary tests have also been made with methallyl chloride, which appears promising as a seed disinfectant.

12.12 : 23.7 : 32 (79.6). MOWAT, E. L. **Damage by logging and slash disposal in Idaho Ponderosa Pine.** *J. For.* 38, 1940 (247–55). [Intermountain Forest & Range Exp. Sta.]

A study of the damage caused by a selective logging operation showed that: (1) Destruction of trees by felling and by skidding long logs with caterpillar tractors amounted to 1,070 seedlings and saplings, 7·5 poles, and 0·7 timber trees per acre. The number of trees seriously injured but not killed by logging averaged 6·2 per acre. (2) During the first year after logging, 2·5 poles and 0·4 timber trees per acre died as an indirect result of logging, chiefly from bark-beetle attack. (3) An average of 544 seedlings and saplings and 6·2 poles per acre were killed by piling and burning slash; this loss varied widely by plots. (4) Percentage of area stocked by trees of any size was reduced from 78 per cent. before logging to 65

per cent. after logging on the area with no slash disposal, and to 49 per cent. on the area with slash piled and burned. (5) Both direct logging damage and destruction by slash burning could be reduced by regulation and closer supervision. *From author's summary.*

12.12 : 32.1. KNUCHEL, H. Schwere Stammbeschädigungen durch horizontale Reisserstriche. [**Severe stem injuries caused by horizontal blazing cuts.**] *Schweiz. Z. Forstw.* 91, 1940 (37–9). [G.]

A description of severe damage, both physical and pathological, observed in a private forest near Zürich.

12.14. Morphology. Anatomy. Histology

12.14 : 12.2. THOMSON, R. B. **The structure of the cone in the Coniferae.** *Bot. Rev.* 6, 1940 (73–84). [University of Toronto.]

12.14 : 12.2. LANGDON, L. M. **Ontogenetic and anatomical studies of the flower and fruit of the Fagaceae and Juglandaceae.** *Bot. Gaz.* 101, 1939 (301–27). O.B.D.

12.14 : 12.2. LIMING, F. G. **Origin and growth of dormant buds in Oaks.** *Abstract* of paper read at a meeting of the Society of American Foresters, Dec. 1939, in *J. For.* 38, 1940 (226). [Central States Forest Exp. Sta.]

Oak sprouts originate from dormant buds which do not develop into normal branches or unfold. The bases of the stem tips increase in length each year in amount equal to the width of the annual ring so that the end is kept on the outside of the stem, and the bud traces thus formed are dwarfed, modified branches encased in the xylem of the main stem.

12.15. Mode of Life. Adaptability. Habit. Phenology

12.15 : 12.19 : 31.1 : 12.2. BUDKEVICH, E. V., and TIKHOMIROV, B. A. **A contribution to the study of the ecological and anatomical characteristics of *Pinus pumila* Rgl.** *Bot. Zh.* 24, 1939 (282–91). [R.e.] A.P.B.

From a study of the ecology and the anatomical characters of Dwarf Pine the conclusion is drawn that this tree is a xerophyte widely distributed in Eastern Siberia and highly adapted to the severe climate of the extreme north. It is considered a very valuable vitamin plant and its needles are being increasingly used in the control of scurvy.

12.15 : 12.2. ZIMMER, O. Die Krone der Eberstädter Kiefer. [**The crown of Eberstadt Scots Pine.**] *Allg. Forst- u. Jagdztg.* 116, 1940 (43–50). [G.]

The author's own data on Eberstadt Scots Pine are discussed and compared with those of other workers, especially Vanselow. The comparison shows that even within a small region and for very similar stands, the average crown size varies so considerably that its expression in absolute figures has little significance.

12.19. Geographical Distribution. Plant Geography and Sociology

12.19.1. *Regional Floras*

12.19.1 (498). CRETZOIU, P. Distribuţia geografică generalĕ a plantelor lemnoase din România. II. [**General geographical distribution of woody plants of Rumania. II.**] *Rev. Pădurilor* 52, 1940 (152–5). [Rum.g.]

Distribution of *Larix decidua* and its variety *polonica*, *Syringa vulgaris*, *S. joszikaea*, and *Calluna vulgaris*.

12.19.1 : 23.21 : 12.15 (61). MANZONI, G. Flora forestale spontanea della Cirenaica ed esperimentazione di specie esotiche. [**The native forest flora of Cirenaica and trials of exotic species.**] *Riv. for. ital.* 2, 1940 (60–78). [It.]

Notes on indigenous forest trees and report on acclimatization experiments with 42 exotic species during 1928–37. Thirty-two species, including numerous Eucalypts and Acacias, have now been acclimatized on an experimental scale.

12.19.1 (67.7). CHEVALIER, A. La flore de la Somalie française et la forêt-relique du Mont Goudah. [**The flora of French Somaliland and the relict forest of Mt. Goudah.**] *C.R. Acad. Sci. Paris* 209 (2), 1939 (73–6). [F.] Biol. Abs. 14 (3295).

12.19.1 (91). HENDERSON, M. R. **The flora of the limestone hills of the Malay Peninsula.** *J. Malay. Br. Asiat. Soc.* 17 (1), 1939 (13–87).

12.19.2. *Forest Types and Woodland Communities past and present*

12.19.2 (43.6). TSCHERMAK, L. Gliederung des Waldes der Reichsgaue Wien und Niederdonau in natürliche Wuchsbezirke. [**Classification of the forest of the provinces of**

Vienna and Niederdonau into natural vegetational districts.] *Cbl. gesamte Forstw.* 66, 1940 (25–35). [G.]

12.19.2 (43.6). TSCHERMAK, L. Gliederung des Waldes der Reichsgaue Kärnten und Steiermark in natürliche Wuchsbezirke. [**Classification of the forests of Carinthia and Styria into natural vegetational regions.**] *Cbl. gesamte Forstw.* 66, 1940 (60–7). [G.]

12.19.2 (43.7). MIKYŠKA, R. Studien über die natürlichen Waldbestände im Slowakischen Mittelgebirge (Slovenske stredohorie). Ein Beitrag zur Soziologie der Karpathenwälder. [**Studies on the natural forest stands of the central mountains of Slovakia. A contribution to the sociology of the Carpathian forests.**] *Beih. bot. Cbl.*, Abt. B., 59 (1), 1939 (169–244). [G.] Biol. Abs. 14 (2032).

12.19.2 (66.9). FAIRBAIRN, W. A. **Ecological succession due to biotic factors in northern Kano and Katsina Provinces of Northern Nigeria.** *Inst. Pap.* No. 22, 1939. pp. 32.

The writer carried out a desiccation investigation in the northern portion of Katsina and Kano Provinces of Nigeria, wherein it was possible to study ecological movement. It was found that there is both soil deterioration and vegetal retrogression due to widespread shifting cultivation and fuel collection. The remedy lies in wise forest reservation and in proper use of the agricultural land by the farmers. The area, vegetation, soil, climate and history are described. A diagrammatic representation of present ecological movement has been prepared. The vegetal types are classified for that part of Northern Nigeria under review. The species found in each formation are listed and ecological succession is described in turn in each formation. The conclusion is recorded that greater harm would seem to accrue in the Western Sudan from soil exposure and insolation than is generally believed, and that the primary aim in land utilization should be to retain a useful vegetation covering on the soil at all times, irrespective of its exploitation by man or cattle. *From author's summary.*

12.19.2 (74.4–6). RAUP, H. M. **Old field forests of southeastern New England.** *J. Arnold Arbor.* 21, 1940 (266–73).

A review, mainly from literature, of ecological succession in forests of abandoned field land in Rhode Island, Massachusetts, and Connecticut.

12.19.2 (75.6). WELLS, B. W. **A new forest climax: the salt spray climax of Smith Island, N.C.** *Bull. Torrey bot. Cl.* 66, 1939 (629–34). O.B.D.

Smith Island, at the Cape Fear angle of the eastern U.S. coast line, is covered with a nearly pure stand of very old climax Live Oaks (*Quercus virginiana*), under which Dogwoods indicate the high degree of soil maturity. Since it has been shown that wind is not the factor controlling the zonation of the coastal dune plants and the form modification of the woody ones, salt spray must be regarded as the selective factor bringing about the dominance and persistance of Live Oak, the only broad-leaved dicotyledonous tree whose mature leaves can withstand moderate salt spray. It is also suggested that the spray factor largely accounts for the distinctive coastal distribution of Live Oak as a dominant throughout its range. *From author's summary.*

12.19.2 : 11 (79.6). LARSEN, J. A. **Site factor variations and responses in temporary forest types in Northern Idaho.** *Ecol. Monogr.* 10, 1940 (1–54). [Iowa State College.]

A study undertaken in northern Idaho to determine and evaluate site factors governing the re-establishment of temporary forest types of the secondary forest succession following forest fires, logging or other denudation. The types studied were Larch-Douglas Fir on a flat bench land, a south-west Western Yellow Pine slope, and Western White Pine on a north-east aspect.

Air-temperature relations showed higher daily and seasonal maxima on the south-west aspect with a relatively longer duration of temperatures favourable to growth. The north-east aspect showed the least extreme in the maxima. The minima of the air temperatures were lowest on the flat, both winter and summer, and highest on the north-east slope. In general, soil temperatures followed the trend of air temperatures. The south-west aspect was characterized by a shallow snow cover of relatively short duration, and the soil moisture reached more critical minima and remained at dangerously low points for extended periods in the summer, and the wind movement and evaporation were more pronounced than elsewhere. The opposite is true for the north-east aspect where the soils contain a greater clay

and silt fraction and higher capillary and other moisture-retaining qualities. In all these relations the Larch-Douglas Fir site appeared to be intermediate. Seedlings, raised from seed on the different sites, expressed by germination, survival, and height growth, a conformity to existing stand conditions, in that White Pine survived only on the northern aspect, and the Western Yellow Pine was practically the only species, out of six, which survived on the exposed south-west slope. These results demonstrate an early selectivity of the native species for their more suitable environmental conditions, expressed primarily through survival and later development rather than by germination. Soil conditions, to a great extent the products of climatic factors, largely determine the order in the progression of temporary types. *From author's summary.*

12.2. *Special [Systematic] Botany*

12.2 : 12.12. CROWELL, I. H. **New species of *Gymnosporangium*.** *Canad. J. Res.* 18, Sec. C, 1940 (10–2). [Faculty of Agriculture of McGill University, Macdonald College, Quebec.] P.R.

Gymnosporangium minus n. sp. on *Cupressus sempervirens* L. near Athens, Greece; *G. guatemalianum* n. sp. on *Amelanchier nervosa* (Dcne.) Standl. and *G. meridissimum* n. sp. on *Cupressus benthami* Endl. in Guatemala.

12.2 : 12.12 : 12.11 (71 : 73). BAXTER, D. V., and MANIS, W. E. ***Polyporus ellisianus* (Merr.) Sacc. and Trott. and *Polyporus anceps* Pk. in culture: a study of isolates from widely separated forest regions.** *Pap. Mich. Acad. Sci.* 24, 1939 (189–95). R.A.M. 19 (310).

Cultural studies of these two Polypores point to the existence of different races or strains within the species. On the other hand, the known morphological distinctions are not regarded as sufficient to separate the two species.

12.2 : 12.11. HERRICK, J. A. **The growth of *Stereum gausapatum* Fries in relation to temperature and acidity.** *Ohio J. Sci.* 39, 1939 (254–8). R.A.M. 19 (125).

12.2 : 12.12 (74.8). OVERHOLTS, L. O. **The genus *Stereum* in Pennsylvania.** *Bull. Torrey bot. Cl.* 66, 1939 (515–37). O.B.D.

12.2 : 12.19.1 (54.1). FISCHER, C. E. C. **Plants new to Assam. XI.** *Kew Bull.* 1940, (31–42).

Includes descriptions of *Tarenna borii*, *Symplocos ifsiana*, and *S. nagensis* spp. nov., all small trees.

12.2 : 31 (63). GIORDANO, G. Cenni monografici sulle piante forestali e sui legnami dell' A.O.I. **[Monographic notes on the forest plants of Italian East Africa and on their woods.]** *Riv. for. ital.* 2, 1940 (32–6, 96–104). [It.]

Notes on *Dombeya schimperiana* A. Rich., *Hypericum lanceolatum* Lam., *Lasiosiphon glaucus* Fresn., *Acacia abyssinica* Hochst., *A. nilotica* Del., *Clausena abyssinica* Engl., *Gardenia lutea* Fresn., and *Oncoba spinosa* Forsk.

12.2 (728). STANDLEY, P. C. **Studies of American plants.—IX.** *Botanical Series, Field Museum of Natural History* 22 (1), 1940. [*Publ.* 463.] (1–62).

Includes descriptions of new Central American tree species.

12.2. PARKER, R. N. ***Abies spectabilis* Spach and *A. pindrow* Spach.** *Indian For.* 66, 1940 (1–3).

It is believed that these two species hybridize freely. They may be distinguished in the field by habit, middle-aged trees of *A. spectabilis* having more widely spread branches and a less conical crown than those of *A. pindrow*. In older trees of *A. spectabilis* the branches are upcurved, while in very old trees the crown gives way to an outcrop of short branches.

12.2 : 34.24 (63). SENNI, L. La coltivazione delle Acacie da tannino in A. O. I. **[The cultivation of Wattles in Italian East Africa.]** *Riv. for. ital.* 2, 1940 (118–26). [It.]

Mainly a discussion of the ecological requirements of *A. mollissima*. A few stands of different *Acacia* species, including *A. mollissima*, already exist in Italian East Africa. At present, the 'Società Anonima Tannini d'Etiopia' is completing preliminary investigations with a view to developing tannin production.

12.2 (57). BASARGIN, I. S. **A new variety of *Acer* in the flora of the [Soviet] Far East.** *Sovetsk. Bot.* 1939 (8), (85–8). [R.] [Far Eastern Section of the Academy of Sciences of the U.S.S.R.] A.P.B.

Description of *Acer tschonoskii* Maxim. var. *rubripes* Kom., which was recently discovered in the Primorskaya (Maritime) Province of Siberia.

12.2 (8). DUCKE, A. **Revision of the species of the genus *Coumarouna* Aubl. or *Dipteryx* Schreb.** *Trop. Woods* 61, 1940 (1–10).

Includes a key to, and short notes on, the individual species, which are trees of the Amazonian region of South America. Four of the species yield the Tonka beans of commerce; all have a very hard and heavy wood, which is little used because it is so difficult to work.

12.2 : 01 (91.4). TIONGSON, C. **Recent changes of nomenclature on some species of Philippine Dipterocarps.** *Philipp. J. For.* 2, 1939 (341–57).

12.2 (68). MARSH, E. K. **A key to the species of *Eucalyptus* grown in South Africa.** *J. S. Afr. For. Ass.* 3, 1939 (16–64).

12.2 (59.3–9). CAMUS, A. Fagacées d'Asie orientale. [**Fagaceae of eastern Asia.**] *Bull. Soc. bot. Fr.* 86, 1939 (155–6). [F.] L.S.

Descriptions of *Lithocarpus crassifolia* and *L. pseudo-vestita* A. Camus spp. nov., from Laos and Tonkin respectively. The former is a shrub, the latter a tree 15–20 m. high.

12.2 (66–7). PELLEGRIN, F. Les *Guarea* (Meliacées) africains. [**The African *Guareas* (Meliaceae).**] *Bull. Soc. bot. Fr.* 86, 1939 (146–54). [F.] L.S.

A key to the African *Guareas*, followed by brief notes on the individual species. Three new species from Gabon—*G. ngounyensis*, *G. oyemensis*, and *G. letestui*—are described.

12.2 (51 : 59.3–9 : 91). AIRY-SHAW, H. K. **Notes on two Asiatic genera of Lauraceae.** *Kew Bull.* 1940, 2 (74–7).

12.2 (932–9). GUILLAUMIN, A. Matériaux pour la flore de la Nouvelle-Calédonie. LIV. Observations sur les Lécythidacées. [**Materials for a flora of New Caledonia. LIV. Notes on the Lecythidaceae.**] *Bull. Soc. bot. Fr.* 86, 1939 (174). [F.] L.S.

A key is provided for the four species of *Barringtonia* now known to occur in New Caledonia.

12.2 : 2 : 3 (91). DURANT, C. C. L. **Nibong.** *Malay. Forester* 9, 1940 (29–31).

Notes on *Oncosperma filamentosa*.

12.2 (59.3–9). GAGNEPAIN, F. Un genre nouveau de Butomacées et quelques espèces nouvelles d'Indo-Chine. [**A new genus of Butomaceae and some new species from Indo-China.**] *Bull. Soc. bot. Fr.* 86, 1939 (300–03). [F.] L.S.

Includes a description of *Platanus kerrii* sp. nov., a tree 20 m. high found in the Laos country, Indo-China.

12.2 : 01. ŽABKA, J. **On the nomenclature of the Poplars from the taxonomical and genetical points of view.** *Lesnická Práce* 18, 1939 (586–91). [Cz.g.]

Many species, varieties, and hybrids of *Populus* require re-classification. Especially *P. canadensis* Moench, which should be listed, for the time being, as a *nomen ambiguum*.

12.2 (56.8–9). CAMUS, A., and GOMBAULT, R. Sur quelques Saules de Syrie et du Liban. [**On some Willows of Syria and the Lebanon.**] *Bull. Soc. bot. Fr.* 86, 1939 (135–40). [F.] L.S.

A new species of Willow that has been confounded with *Salix fragilis* L. and *S. safsaf* Forsk. is described by the authors under the name *S. pseudo-safsaf*. *S. fragilis* and *S. safsaf* are apparently absent from Syria and the Lebanon, being replaced in this region by *S. pseudo-safsaf* and *S. australior* And. *S. dinsmorei* Enander is found with the two latter species near Aleppo and is thought to be a hybrid between them. *From authors' summary.*

12.2 (91.1). MERRILL, E. D., and PERRY, L. M. **The Myrtaceous genus *Syzygium* Gaertner in Borneo.** *Mem. Amer. Acad. Arts and Sci.* 18 (3), 1939 (135–202). Biol. Abs. 14 (3270).

12.2 (51 : 59.1). GAUSSEN, H. Une nouvelle espèce de *Taiwania*, *T. flousiana*. [**A new species of *Taiwania*, *T. flousiana*.**] *Trav. Lab. for. Toulouse*, Tôme 1, Vol. 3, Art. 2. 1939. pp. 9. [F.]

T. flousiana is a tall tree up to 75 m. high, growing in Upper Burma, western Yunnan, and eastern Tibet. A tabular comparison is given of the characters of this species and *T. cryptomerioides*, the only other known representative of the genus.

12.2 (51). CHENG, W. C. Une espèce nouvelle d'*Ulmus* chinois, *U. gaussenii*. [**A new Chinese species of *Ulmus*, *U. gaussenii*.**] *Trav. Lab. for. Toulouse*, Tome 1, Vol. 3, Art. 3. 1939. pp. 2. [F.]

The new species is a tree up to 20 m. high from the lower basin of the Yang-tse-Kiang.

13.1. *General Zoology*

13.1 : 13.2. GYÖRFI, J. **On the significance of parasitic wasps in forestry.** *Erdész. Kisérl.* 41, 1939 (117–242). [Hu.g.] [Institut für Forstschutz der Kön. ung. Palatin-Josef-Universität für technische und Wirtschaftswissenschaften.]

Laboratory and field investigations during 1930–8 on 177 different host insects and 354 species of parasitic wasps. In the course of the work, 24 parasitic species were bred, the hosts of which had hitherto been unknown, and two new Chalcid species were discovered. According to the laboratory results, any considerable population increase of the wasps requires a predisposition of the host insects. This occurs when the hosts are weakened by such factors as hunger, unfavourable weather conditions, wet food, and frequent change of food where the habitual food plant is scarce. These results were confirmed by field observations in various parts of Hungary during the *Lymantria dispar* years 1929–34.

13.1 : 12.12 : 12.2 : 13.2. CALLAN, E. McC. **Hymenopterous parasites of Willow insects.** *Bull. ent. Res.* 31, 1940 (35–44). [Imperial College of Tropical Agriculture, Trinidad.]

13.1 : 12.12 : 13.2. GYÖRFI, J. **Woodwasps and the damage done by them.** *Erdész. Lap.* 79, 1940 (77–95). [Hu.g.f.e.]

The average depth of grub-holes caused by *Xeris*, *Taururus*, and *Sirex*, was 7 cm., causing a reduction of the utilizable diameter by 14 cm. The damage in a given conifer stand appeared to be the more severe, the older the stand, the better the soil, and the greater the number of stumps which had been left after felling.

13.1 : 13.2 : 12.12 : 12.2. GARTHWAITE, P. F., and DESAI, M. H. **On the biology of the parasites of the Teak defoliators, *Hapalia machaeralis* Walk. (Pyralidae) and *Hyblaea puera* Cram. (Hyblaeidae) in Burma.** *Indian For. Rec. (n.s.) Entomology* 5, 1939 (309–53). [Branch of Forest Entomology, Working Plans Circle, Maymyo, Burma.]

One hundred and sixteen species of parasites bred out of material of these two insects are dealt with; of these, 47 species are primary parasites of *Hapalia machaeralis*, and 29 species are primary on *Hyblaea puera*, 11 species being common to both. Fifty-three species are hyperparasitic, 46 on *Hapalia machaeralis* and 12 on *Hyblaea puera*. *Cedria paradoxa* Wlkn. (Braconidae), a parasite of *Hapalia machaeralis* recently introduced from India, is included. The biology of the species is discussed as far as it is known. The method of breeding *Apanteles machaeralis* Wlkn. (Braconidae) in the Insectary is described. *From authors' summary.*

13.1 : 13.2 : 12.12 : 12.2. BEESON, C. F. C., and CHATTERJEE, S. N. **Further notes on the biology of parasites of Teak defoliators in India.** *Indian For. Rec. (n.s.) Entomology* 5, 1939 (355–79). [Branch of Forest Entomology, Forest Research Institute, Dehra Dun, India.]

Additional data on distribution, hosts, life-cycles, &c., are given for 23 hymenopterous and 6 dipterous species of parasites of Teak defoliators in India. Experiments in the introduction and colonization of parasites between Burma and India and *vice versa* are described. During 1937 and 1938 four foreign species of parasites were liberated in Nilambur, South India, and three species were despatched from India to Burma. Data are recorded on the parasitism percentages of *Hapalia machaeralis*, *Hyblaea puera*, *Lygropia quaternalis*, and *Sylepta* spp. in Nilambur in 1937 and 1938. *Authors' summary.*

13.1 : 13.2 : 12.12 : 12.2. CHATTERJEE, P. N. **On the biology and morphology of *Apanteles machaeralis* Wlkn. (Braconidae, Hymenoptera).** *Indian For. Rec. (n.s.) Entomology* 5, 1939 (381–95). [Zoology Department, University of Allahabad.]

Apanteles machaeralis Wlkn. is a solitary internal parasite of *Hapalia machaeralis*, Walker.

13.1 : 13.2. THALENHORST, W. Zur Biologie des Kiefernspannerparasiten *Ichneumon nigritarius* Grav. [**On the biology of the Pine looper moth parasite *I. nigritarius* Grav.**] *Z. angew. Ent.* 26, 1939 (185–208). [G.g.] [Institut für Waldschutz der Preussischen Versuchsanstalt für Waldwirtschaft, Eberswalde.]

13.1 : 13.2. MÜLLER, F. P. Sterblichkeit und Wachstum der Kiefernspannerraupe bei Futter aus Reinbeständen und aus Mischwald. [**Mortality and growth of larvae of the Pine looper moth on food from pure**

stands and mixed forest.] *Z. angew. Ent.* 26, 1939 (359–67). [G.g.] [Entomologisches Seminar der Universität Rostock.]

The result of an experiment undertaken in Mecklenburg indicates that the relative immunity of Pine growing in mixed stands to this insect is not due to either nutritional or climatic factors.

13.1 : 13.2. : 12.2. HARRAR, J. G., and MARTLAND, J. G. **A fungous parasite of the Pine bark beetle.** [*Abstract* of paper read at the 31st annual meeting of the American Phytopathological Society.] *Phytopathology* 30, 1940 (8).

Larvae of *Dendroctonus frontalis* in bark of *Pinus echinata* from Virginia were apparently parasitized by a fungus tentatively identified as a species of *Beauveria*.

13.1 : 13.2 (71). BALCH, R. E. **The Spruce sawfly outbreak in 1939.** *Woodlands Rev.* 11 (3), 1940 (5–9).

The form of Spruce sawfly found in eastern Canada occurs in Europe but has constant differences in biology, morphology and chromosome number from the closely related *Diprion polytomum* (*Gilpinia polytoma*). The present position of this insect in eastern Canada is discussed in relation to natural control, introduced parasites, present distribution and infestation, and damage. A disease having the characteristics of a virus infection occurred in the feeding larva during the summer of 1939, particularly in southern New Brunwswick (a two-generation area), where the mean temperature during July and August was 4–7° F. above normal and precipitation 25–90 per cent. below normal.

Less than 0·02 per cent. of the cocoons of this insect has been successfully attacked by native parasites. Large numbers of the introduced parasite *Microplectron fuscipennis* were released as well as smaller numbers of other species. *Microplectron* is well adjusted to climate and altitude conditions in New Brunswick and southern Quebec. It has increased remarkably in southern New Brunswick where it is favoured by warm summers and little rain and can produce four generations. Weather conditions are less favourable in northern New Brunswick and Quebec. This parasite can attack cocoons under compact layers of leaves and grass and under moss to a depth of 3 in. The only other species of introduced parasite that shows definite control value is *Exenterus*. It is concluded that for 1939 the weather conditions, diapause, disease, and parasites have combined to prevent important increases in sawfly population and in many places reductions have been noted. A map is included showing the present known distribution of the insect in eastern Canada and the United States.

13.1 : 13.2. LINDNER, E. Über die Tachinen aus zwei Nonnenfrassgebieten. [**On the Tachina flies of two feeding areas of the Nun Moth.**] *Anz. Schädlingsk.* 16, 1940 (20–1). [G.]

13.1 : 13.2. SCHWERDTFEGER, F. Untersuchungen über die Wanderungen des Maikäfer-Engerlings (*Melolontha melolontha* L. und *Melolontha hippocastani* F.). [**Research on the movements of the cockchafer larvae (*M. melolontha* and *M. hippocastani*).**] *Z. angew. Ent.* 26, 1939 (215–52). [G.g.] [Eberswalde.]

Detailed account of a variety of field and laboratory observations made in Germany on the movement of the larvae in the soil.

13.1 : 13.2 (51). MIAO, C. F. **Study on some forest insects of Nanking and its vicinity. Pt. II. Observations on lappet moth (*Metanastria ampla* Walker).** *Contr. biol. Lab. Sci. Soc. China* (*Zool.*) 13 (2), 1939 (9–22). R.A.E. A28 (68).

Studies on the bionomics of *M. ampla*, which attacks various forest trees in the lower Yangtsze Valley and is an important pest of Oak.

13.1 : 12.12 : 13.2 : 12.2. LÁSZLÓ, T. Über die Biologie der Blattlaus *Pemphigus spirothecae* Pass. [**On the biology of the aphid *P. spirothecae*.**] *Z. angew. Ent.* 26, 1939 (297–311). [G.g.] [Ungarisches Nationalmuseum, Abteilung für Zoologie, Budapest.]

13.1 : 12.12 : 13.2. DAUTER. Untersuchungens über die Zusammensetzung und Aufnahme der Äsung des Rotwildes und ihre Beziehungen zur Schälfrage. [**Research on the composition of the forage and on the feeding times of the red deer in relation to the problem of bark scaling.**] *Mitt. Forstwirt. Forstwiss.* 10, 1939 (216–30). [G.g.] [Institut für Jagdkunde der Forstl. Fakultät der Georg-August-Universität Göttingen in Hann.-Münden.]

From preliminary results based on the examination of 369 rumens, it appears that the intensity of bark scaling depends mainly on

the ability of red deer to find and to consume without being disturbed, during the morning hours, food other than bark, tree shoots, bacciferous herbs, and the usually poor grass of the stands to which it normally has to confine itself during the day.

13.2. *Special* [*Systematic*] *Zoology*

13.2 : 05.3 (71). CANADA. **Annual report of the Forest Insect Survey, Division of Entomology, Science Service, 1939.** Govt. Printer, Ottawa, 1940. pp. 37.

A total of 8,310 samples of forest tree insects were taken and recorded during 1939. Sectional maps show the distribution of these collections throughout the country. The insects are listed under their host tree species with brief notes on information obtained from the survey.

13.2 (931). DUMBLETON, L. J. **Buprestid beetles in New Zealand.** *N.Z. J. For.* 4, 1939 (256).

The two native species in New Zealand, *Nascioides enysii* Sharp and *Neocuris eremita* White, do not appear to be primary pests. Some habits of *N. enysii* and a description of the eggs of both insects are noted. Other species that have been reported in New Zealand are *Buprestis aurulenta* L. (*B. lauta*) and *Stigmodera gulielmi*.

13.2 (54 : 59.1). CORPORAAL, J. B. **Some Cleridae from India, Burma and Ceylon with descriptions of new species and notes on others.** *Indian For. Rec.* (*n.s.*) *Entomology* 6, 1939 (17–39). [Zoological Museum, Amsterdam.]

13.2 (560). EGGERS, H. Zur paläarktischen Borkenkäferfauna. VII. Fünf neue Arten aus Anatolien. **[On the palaearctic bark-beetle fauna. VII. Five new species from Anatolia.]** *Cbl. gesamte Forstw.* 66, 1940 (36–9). [G.]

Descriptions of *Crypturgus apfelbecki* and *C. cylindricollis* from *Picea orientalis* and *Pinus* [*nigra* var.] *austriaca*, and of *Cryphalus subdepressus*, *Taphrorychus schimitscheki*, and *Trypodendron meridionale* from *Abies bornmülleriana*. Some of these new species occur in the Alpine-Carpathian region of S. Europe as well as in Asia Minor.

13.2. GÄBLER, H. Unterscheidungsmerkmale der Tönnchen der Nonnentachine *Parasetigena segregata* Rdi. und der Kieferneulentachine *Panzeria rudis* Fall. **[Distinguishing characters of the coarctate pupae of *Parasetigena segregata*, the nun-moth Tachina fly, and *Panzeria rudis*, the pine-beauty Tachina fly.]** *Forstwiss. Cbl.* 62, 1940 (10–5). [G.] [Forschungsstelle für Nonnenbekämpfung der Forstlichen Versuchsanstalt Tharandt.]

2. SILVICULTURE

2 (71). PEPLER, W. A. E. **Advancements in silviculture.** Woodlands Section, Canadian Pulp & Paper Association, Montreal. [*Woodlands Section Index* No. 490 (F–2).] 1939. pp. 3.

A classification and summary of replies from a number of foresters to a questionnaire issued in connexion with the paper 'Silviculture in relation to logging' by A. Koroleff [summary in *J. For.* 36, 1938 (957)].

2 : 3 : 12.11 : 12.2 (47.1). LEHONKOSKI, N. A. Känner du ditt björkbestånd? **[Do you know your Birch wood?]** *Skogen* 27, 1940 (3–6, 57–9, 77–9). [Sw.]

Under the former practice of alternate agriculture and forestry in Finland, the burning-over and tilling of the land favoured Birch regeneration. During the last century, however, the gradual lapse of this practice, and the rise of sawmilling with its insistent demand for coniferous timber, led to the deterioration and neglect of Birch woods. Since the establishment of the first veneer and plywood factory in 1912, Birch has become an important raw material, and exports of Birch products are now a very important feature in the national economy. Owing to the past neglect of Birch woods, most of the available supply is of extremely poor quality, but the demand is so urgent that even low-grade material is accepted by industry for lack of better. In 1937–38 the outturn of first-quality veneer made up only 1 per cent. of the total production, the figures for the remaining grades, in descending order of quality, being 10, 30, and 59 per cent. respectively. It follows that silvicultural measures, including the selection of races known to produce high-grade timber, will be justified by the high prices commanded by sound, knot-free,

reliably graded logs. Although scientific investigation of races of Birch is still in a preliminary stage, it is known that certain races yield higher proportions of high-grade veneer than others. Four chief races are tentatively distinguished; of these two often produce high-grade and two almost always low-grade material. The main silvicultural requirements of Birch are ample light, a good soil-nutrient supply, and protection from grazing. The abundance and frequency of seed production compensate for the low viability (25–35 per cent.) of the seed. Regeneration is readily obtained after wounding the soil, burning over, or removing the moss cover, provided that the regeneration areas are large enough to admit sufficient light. Large gaps or strips with marginal seedbearers may be made, or all the trees except isolated seedbearers may be felled over a large area. Only high-grade trees should be left as seedbearers. The regeneration should be left undisturbed for 10–12 years; cleanings may then be necessary, but should be cautious in order to maintain a high density of stocking. At 10–12 cm. d.b.h., crop trees should be selected and pruned. The final number of such trees will not exceed 400 to 600 per ha.; they should be selected for race and clean vigorous growth, and should be so spaced that they will not interfere with later thinnings. After the marking and pruning of crop trees, a first thinning should be made and subsequent thinnings should take place at 5-year intervals, always with a view to providing ample space for the crowns of the final crop. If Spruce exists in the neighbourhood, its seedlings may be expected to come up and thrive under the Birch. Should they be late in appearing, Spruce may be underplanted so as to reach pulpwood size before the Birch is removed. Two alternative methods of treatment exist:—(*a*) to remove all the Birch except for seedbearers and to fell the Spruce for pulpwood, thus leading back to pure Birch; and (*b*) to remove all the Birch and leave the Spruce to grow on to pulpwood of larger size or to sawtimber, after which the stand may be regenerated to Birch or Spruce, according to conditions. It is estimated that the value of the final yield from a unit area treated on the suggested lines would be that of 10 times the area under present conditions.

2 : 34.25 : 12.2 (91–2). **Cinchona culture in the Netherlands East Indies.** *E. Afr. agric. J.* 5, 1940 (283–6).

2 : 12.2. Anderson, M. L. **The silviculture of the Larches.** *Scot. For. J.* 54, 1940 (22–32).

2 : 6 : 34.26 : 12.2. **Dual-purpose Pines.** *Leafl. U.S. Dep. Agric.* No. 168, 1939. pp. 8.

Popular leaflet on the management of Longleaf and Slash Pines as grown for the dual purpose of timber and resin production.

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

21.1 : 11.46 : 12.2. Bruev, S. M. **The effect of soil conditions on shade tolerance of trees.** *Trudy beloruss. s.-kh. Inst.* 8 (30), 1939, (74–6). [R.] S. & F. 3 (90).

In a pot experiment with two different soils no effect was noticed with the experimental trees—Siberian Larches.

21.2 : 12.11. Pisek, A., and Cartellieri, E. Zur Kenntnis des Wasserhaushaltes der Pflanzen. IV. Bäume und Sträucher. [**On the water régime of plants. IV. Trees and shrubs.**] *Jb. wiss. Bot.* 88, 1939 (22–68). [G.g.] L.S.

In the course of investigations near Innsbruck during 1935–7, the transpiration, osmotic value, and water content of fairly isolated, 3–4 m. high specimens of *Betula verrucosa*, *Hippophaë rhamnoides*, *Corylus avellana*, *Larix decidua*, *Fagus sylvatica*, *Pinus sylvestris*, and *Picea excelsa*, were determined on clear, calm days throughout a vegetation period. In spring, shortly after the opening of the buds, the rate of transpiration, as calculated for a period of equal evaporation, was smaller than in summer, and decreased in autumn previous to the discoloration of the foliage until it finally sank to very small values. Major fluctuations in the rate of transpiration, were, on the whole, correlated with corresponding modifications in pore aperture as determined by the infiltration method. Even on normal, fine days and with moist soil conditions, the rate of transpiration began to diminish relatively early in the day in all trees except *Hippophaë* and *Betula*. On the leaves reaching a saturation deficit of 16–24 per cent. transpiration in *Corylus*, *Fagus*, and *Picea* became entirely cuticular, and nearly so in *Betula*. Shaded foliage transpired less than foliage exposed to the sun, but the transpiration/evaporation ratio was not sensibly diminished except in *Fagus*, where the diminution could be attributed mainly to smaller apertures of the stomata. On warm, cloudy

days, transpiration was somewhat higher, compared with evaporation, than in clear weather. The monthly water utilization for the period May to September, per sq. m. of soil surface covered by the crown canopy, was estimated at from 30 l. for *Hippophaë* to 90 l. for *Corylus*, while the average monthly rainfall during that period was 96 mm.

21.2 : 12.2 (78–9). ROESER, J. **The water requirement of Rocky Mountain conifers.** *J. For.* 38, 1940 (24–6). [Rocky Mountain Forest & Range Exp. Sta.]

Seedlings of six tree species were grown in galvanized-iron water-tight containers over a period of ten years and supplied with water at regular intervals. Based on the magnitude of average daily water loss the species tested rank as follows: Engelmann Spruce, Douglas Fir, Pinon Pine, Ponderosa Pine, and Limber Pine. In relative efficiency of use of water in production of organic matter the species ranked in decreasing order as follows: Pinon Pine, Douglas Fir, Engelmann Spruce, and Ponderosa Pine, when grown on loam; Pinon and Limber Pine on Permian red sand.

21.5 : 12.2 (74.2). LUTZ, H. J. **Layering in Eastern White Pine.** *Bot. Gaz.* 101, 1939 (505–7). [School of Forestry, Yale University.] O.B.D.

A case is reported of natural layering of an isolated branch of a *Pinus strobus* in the Yale Demonstration and Research Forest, New Hampshire. This is apparently the first record of natural layering of *Pinus* in America.

21.5 : 23.26.5 : 12.2. JACOBS, M. R. **The vegetative reproduction of forest trees. I. Experiments with cuttings of *P. radiata* Don.** *Bull. For. Bur. Aust.* No. 25, 1939. pp. 30.

Encouraging results have been obtained, both in the nursery and the field, with cuttings taken from trees (*Pinus radiata*) which are old enough to show the form of the butt log. *From author's summary.*

21.6 : 23.24 : 12.19.2. MINCKLER, L. S. **Vegetative competition as related to plantation success in the Southern Appalachian Spruce Type.** *J. For.* 38, 1940 (68–9). [Appalachian Forest Exp. Sta.]

The density of competing vegetation is the factor that is important in effecting plantation development. The following abbreviated table shows the percentages of thrifty trees under different conditions of competition as determined in this study. The species examined were Red Spruce and Red Pine from 2 to 7 years old.

Percentage of thrifty Red Spruce

Overtopped	Side competition only	Free
per cent.	per cent.	per cent.
20·1	53·7	75·0

Percentage of thrifty Red Pine

Overtopped	Side competition only	Free
per cent.	per cent.	per cent.
42·3	76·1	92·7

The height growth of both species was by far the poorest for trees overtopped by competing vegetation.

21.6 : 23.24 (78.6 : 79.6–7). SCHOPMEYER, C. S. **Survival in forest plantations in the Northern Rocky Mountain Region.** *J. For.* 38, 1940 (16–24). [Northern Rocky Mountain Forest & Range Exp. Sta.]

During the period 1910–37, a total of 1,150 plantations were established on an aggregate area of 93,878 acres in western Montana, northern Idaho, and north-eastern Washington. The means of all recorded first-year survival percentages of spring-planted Western White Pine and Ponderosa Pine trees are 7 and 10 per cent. higher, respectively, than those of fall-planted trees of the same species. An analysis of all available first- and third-year survival data on plantations of various age classes of planting stock showed that there are no significant differences in survival between age classes of stock of either Western White Pine or Ponderosa Pine. The mean tenth-year survival percentage of 210 plantations distributed over the region on an aggregate area of 29,589 acres is 42 per cent. *Author's summary.*

21.6 : 65 : 12.2. BONNEMANN, A. Der gleichaltrige Mischbestand von Kiefer und Buche. **[Even-aged mixed stands of Pine and Beech.]** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (439–83). [G.g.]

Contains a yield table for 1st-quality stands (1st quality for dominant species Pine) constructed for a Pine density corresponding to ·6 in Schwappach's table of 1908. From age 60 years onward the total volume production of the mixed stands exceeds that of comparable pure Pine stands, and this superiority amounts to 12 and 27 per cent. at the ages of 120 and 160 years respectively. On the other hand,

production in terms of gross income is greater in pure stands up to the age of 140–160 years. The mixed stands are more suitable for the growing of large-size Pine timber on a long rotation and where this is the aim, thinnings in Pine are fairly heavy.

21.6 : 64 : 65 : 12.2 (931). MOORHOUSE, R. B. **The growth of even-aged young *Nothofagus* forest in the more accessible and better quality sites of the Reefton District.** *N.Z. J. For.* 4, 1939 (205–17).

The report of a study of native Beech regeneration, particularly pole and sapling stands, based on 23 sample plots mostly one-quarter acre in area. The species *Nothofagus fusca* is the main mining timber for the district and so was the principal object of the study. It is relatively intolerant of shade, grows fairly quickly, and is dominant on the best sites with moist well-drained soils. Other species of Beech included in the study were *N. truncata* and *N. menziesii*, the former being relatively less tolerant of shade, faster growing and having a durable wood. It was found that site quality tapers off rapidly with increasing altitude in hilly country and considerable variation in species and in the general growth of Beech was found over short horizontal distances in this region. Where possible the relationship of age and site with height and volume growth was shown.

21.7 : 12.15 : 56 : 31.8. JACOBS, M. R. **A study of the effect of sway on trees.** *Bull. For. Bur. Aust.* No. 26, 1939. pp. 19.

Four test plots were set up in different stands of *Pinus radiata* and one plot in a sapling stand of *Eucalyptus gigantea*. The measurement of the increments on all plots showed that the prevention of sway caused a marked reduction in diameter growth in the lower part of the bole. *From author's summary.*

22. SYSTEMS OF MANAGEMENT. FORMS OF STAND. [SILVICULTURAL SYSTEMS]

22 : 09.7 : 12.2 (44). NOISETTE, M. Les hêtraies des Basses Vosges. **[The Beech woods of the Basses Vosges.]** *Rev. Eaux For.* 78, 1940 (1–17). [F.]

22 : 32 : 34.26 : 12.2 (44). LAPASSE, L. DE. Le traitement des forêts des dunes de Gascogne. **[The treatment of the dune forests of Gascony.]** *Rev. Eaux For.* 77, 1939 (981–6). [F.]

22 : 33.0 : 33.32 : 12.2 (44). JOUBERT, A. Organisation de la forêt française et production des bois papetiers. **[Organization of French forests and production of pulpwoods.]** *Rev. Eaux For.* 77, 1939 (963–80). [F.]

Spruce and Silver Fir should receive different treatments for pulpwood production: even-aged pure plantations with clear cutting and artificial regeneration for Spruce, while Silver Fir should be managed under a very elastic selection system, in mixture with species such as Beech, with a view to the rapid production of large quantities of medium-size material. The State should create some 300,000 ha. of forests of the latter category by afforestation in the Massif Central.

22.1 : 12.2 (77.4–5). EYRE, F. H., and NEETZEL, J. R. **Practical cutting methods for northern hardwoods.** *Pap. Mich. Acad. Sci.* 4 (1), (1938) 1939 (197–208). [Lake States Forest Exp. Sta.] L.S.

A discussion of cutting experiments in Michigan and Wisconsin, for which a complete record is available of tree growth over a ten-year period following light, moderate, and heavy cuttings that removed 29, 62, and 90 per cent. respectively of the saw-timber volume. The results show that a selective cutting in which one-third to two-thirds of the volume is removed is good practice in northern hardwood forests, while heavy cuttings of the 'commercial' type, resulting in the removal of 90 per cent. of the volume, are disadvantageous. The advantages and disadvantages of each type of cutting are reviewed.

22.4 : 34.21 : 97 (54.3). SAGREIYA, K. P. **On the desirability of cultivating fodder-yielding trees in the Central Provinces.** *Indian For.* 66, 1940 (14–6).

Common tree species of the Central Provinces that are of possible value for cattle fodder are listed. Under present conditions of cheap grazing and relatively high forest production costs fodder tree crops are not economically feasible.

23. FORMATION OF STANDS

23 : 12.19 : 12.2 (76.2). GEMMER, E. W., MAKI, T. E., and CHAPMAN, R. A. **Ecological aspects of Longleaf Pine regeneration in**

South Mississippi. *Ecology* 21, 1940 (75–86). [Southern Forest Exp. Sta.]

Protection of Longleaf Pine seed from birds and rodents is essential for the establishment of seedling stands. A heavy stand of second-growth old-field Pine is more effective protection than grasslands or scrub Oak stands. Field experiments indicate that the protection from natural rough is more important to the establishment of seedlings from natural seedfall than is the burning over and cultivation of the seedbed. Small wire tubes, mulches, and a mechanical drill seeder gave promise of better establishment from artificial seeding.

Greenhouse tests in regard to seedbed conditions indicated that (*a*) Longleaf Pine seed germinated and became established best on mineral soils and on light, well-drained humus, (*b*) heavy deposits of ash from burned litter was detrimental to seedling establishment, (*c*) hardness and compaction of soils affected penetration of the radicles, and (*d*) mechanical loosening of dense soils favoured seedling establishment.

The rate of germination of Longleaf Pine seed varied with the quantity of water applied and the frequency of application, and one or two soakings at long intervals hastened germination.

23 : 43 : 12.2. WATSON, L. **Controlled burning and the management of Longleaf Pine.** *J. For.* 38, 1940 (44–7). [Yale School of Forestry.]

A discussion of the data available from the literature on this problem. It is concluded that properly controlled burning at intervals of several years is the most efficient method of using fire in the management of Longleaf Pine.

23.1. *Natural Formation of Stands*

23.1 : 22.21 : 12.2. POSKIN, A. A propos de la régénération naturelle du chêne en taillis sous futaie. **[On the natural regeneration of Oak in coppice with standards.]** *Bull. Soc. for. Belg.* 47, 1940 (1–10. [F.]

Plot experiments during 1934–7 showed that pheasants and rabbits when occurring in large numbers, were capable of preventing natural regeneration by destroying acorns and seedlings. Sometimes moles contributed to the damage. Regeneration was fairly successful where the acorns had been artificially covered with earth.

23.1 : 12.2 (71.5–6). LONG, H. D. **Spruce regeneration in Canada: The Maritimes.** *For. Chron.* 16 (Spec. No.), 1940 (6–9). [Dominion Forest Service, Fredericton, N.B.] Discussion by K. B. Brown in *For. Chron.* 16, 1940 (68).

23.1 : 12.2 (71.4). ROY, H. **Spruce regeneration in Canada: Quebec.** *For. Chron.* 16 (Spec. No.), 1940 (10–20). [Quebec Forest Service, Quebec, P.Q.] Discussion by J. R. Walton in *For. Chron.* 16, 1940 (68–74).

23.1 : 12.2 (71.3). MILLAR, J. B. **Spruce regeneration in Canada: Ontario.** *For. Chron.* 16 (Spec. No.) 1940 (21–9). [William Boniface L'b'r. Co., Marenisco, Mich.] Discussion by J. Raeburn in *For. Chron.* 16, 1940 (74–6).

23.1 : 12.2 (71.21). PHELPS, V. H. **Spruce regeneration in Canada: The Prairie Provinces.** *For. Chron.* 16 (Spec. No.), 1940 (30–7). [Dominion Forest Service, Winnipeg, Manitoba.] Discussion by E. H. Roberts and H. P. Eisler, and H. L. Holman and H. A. Parker, in *For. Chron.* 16, 1940 (76–9, 79–83).

23.1 : 12.2 (71.1). MCKINNON, F. S. **Spruce regeneration in Canada : British Columbia.** *For. Chron.* 16 (Spec. No.), 1940 (37–45). [Forest Branch, Department of Lands, Victoria, B.C.] Discussion by B. G. Griffith in *For. Chron.* 16, 1940 (83–4).

A symposium of five papers dealing with the problem of Spruce regeneration in Canada, each paper concerned with the particular conditions in one of the five geographical regions, the Maritimes, Quebec, Ontario, the Prairie Provinces, and British Columbia.

23.1 : 12.2 (931). MOORHOUSE, R. B. **Notes on regeneration of Podocarps under Beech in sample plots in the Reefton District.** *N.Z. J. For.* 4, 1939 (253–5).

An unexpectedly large quantity of Podocarp seedlings and saplings was found under a forest that is predominantly Beech. The species of Podocarp most common were *Dacrydium cupressinum* and *Podocarpus ferrugineus*, the former often becoming established in the presence of dense groups of the plant *Blechnum discolor*, which may have been a deterrent to the competing Beech regeneration.

23.13 : 12.2 (931). FIELD, J. F. **Preparation of the forest floor for seed reception.** *N.Z. J. For.* 4, 1939 (248).

Under a Beech-Taxad association, where the

main species, *Nothofagus fusca*, is largely overmature, the thick layer of duff and litter on the forest floor prevents seedlings reaching the mineral soil and becoming established. Preparations for regeneration, which appear to give successful results, included removal of all trees but a light stand of healthy, well-formed Beech as seed trees, and scraping away the duff layers from the soil in patches 2 to 3 ft. in diameter at a spacing of approximately 6 ft. The latter operation cost £2 per acre.

23.2. *Artificial Formation of Stands. Artificial Regeneration*

23.21. Choice of Species

23.21 (47.3 : 47.6). D'YACHENKO, A. E. **A contribution to the problem of cultivating valuable fast-growing tree species.** *Sovetsk. Bot.* 1939 (4), (127–36). [R.] A.P.B.

Evidence is submitted to show that *Juglans mandshurica* Max., a native of eastern Siberia, and *J. cinerea* L. can be grown commercially in European Russia south of the Polotsk-Vitebsk-Smolensk-Kaluga-Ryazan-Saratov line (54–58° northern latitude), and that the height and diameter growth of the two species compares very favourably with those of first- and second-quality Oak stands.

23.21 : 23.3 : 11 (491). BJARNASON, H. Betingelser for Trævækst i Island. [**Conditions for tree growth in Iceland.**] *Dansk Skovforen. Tidsskr.* 1940 (1–8). [Da.]

The climate of Iceland closely resembles that of certain parts of Alaska; hence it should be worth while to try at least some of the Alaskan conifers. In the author's opinion, Kofoed Hansen's statement [*For. Abs.* 1 (155)] on the impracticability of raising exotics is premature. The stock hitherto introduced has not been of correct provenance, being derived from regions with a higher mean summer temperature or a continental type of climate. The one exception is at Hallormsstadur: here Scots Pine from the vicinity of Trondhjem has come through a period of stagnation and is now showing normal growth. The trees, which were planted under side shelter from Birch, are now 4–5 m. high at 35 years of age; last year's height growth was 20–50 cm., and the branchlets retain their needles for 3–4 years. *Picea engelmannii* has also done fairly well in this locality, but is not sufficiently frost-hardy. Final judgment on the possibility of raising exotic conifers in Iceland must be deferred until species and races of suitable climatic origin have been tried under side and overhead shelter from the native Birch.

23.21 : 23.3 : 42.4 (68.7). KING, N. L. **Reclamation of the Port Elizabeth drift sands.** *J. S. Afr. For. Ass.* 2, 1939 (5–10). [Division of Forestry, Union of South Africa.]

During the period from 1893 to 1909 an area of 11,000 acres of waste sand was reclaimed at a gross cost of approximately £61,000. Seed of *Acacia cyclops* and *A. saligna* was sown to provide a permanent covering, Rye and Pyp grass (*Ehrharta gigantea*) were sown to protect the Wattle seedlings, and the whole area was covered with town refuse (a total of 58,571 truck loads) to keep the sand in place until the vegetation became established. Plantations are now well established and natural regeneration is profuse. A yield of 852,191 cu. ft. of firewood was obtained from the area for the 3-year period ending March, 1938. Of the two species of Wattle, *Acacia cyclops* appears the best suited for drift-sand reclamation.

23.21 : 23.3 : 12.2 (729.5). HOLDRIDGE, L. R. ***Calophyllum antillanum*, a desirable tree for difficult planting sites.** *Carib. For.* 1 (2), 1940 (27–8). [E. span.]

Besides furnishing a useful timber, *Calophyllum antillanum* Britton (*C. calaba* Jacq.) has proved extremely adaptable in its site requirements. Plantations in Puerto Rico have succeeded on difficult sites including an arid, impermeable, phosphorus-deficient, eroded clay over serpentine rock, shallow-soiled tops of exposed hills of porous limestone, and swampy, flat land at about 2,000 ft. altitude with a rainfall of some 100 in. per annum. On the first-named site the red clay has been changed to a darker, more porous and fertile soil. Direct sowing is the best method of raising stands, as the seedlings are rather difficult to transplant. The seedlings are able to compete with other vegetation; natural pruning takes place at an early age; and so far no outstanding pests or diseases have appeared. Though stored seed gives a fair germination, fresh seed is preferable.

23.21 : 31 : 12.2 : 13.2 (729.5). WOLCOTT, G. N. **The entomologist looks at Maga.** *Carib. For.* 1 (2), 1940 (29–30). [E. span.] [Agricultural Exp. Sta., Rio Piedras, Puerto Rico.]

Maga (*Montezuma speciosissima* Sessé and Moc. (*Thespesia* or *Maga grandiflora*)) is

suggested for planting as a substitute for Mahogany in Puerto Rico, on account of its far more rapid growth and slightly higher resistance to the polilla (*Cryptotermes brevis* Walker). Its wood is similar to that of Mahogany, and is well suited to furniture making, although at present it is little used because of the lack of commercial supplies. The tree has no serious insect pests; its seed pods, however, can serve as alternate hosts for the pink bollworm, and it is thus not suitable for planting in the cotton-growing districts.

23.22. Tools for Cultural Work

23.22 : 07.7. OPSAHL, W. Hopes skogsharv. **[Hope's forest harrow.]** *Tidsskr. Skogbr.* 48, 1940 (17–9). [Nor.]

The essential feature of this horse-drawn harrow, invented by A. Jørgensen Hope, is a revolving drum on which are mounted stout metal teeth that can be held clear of the ground or let down by means of a lever which simultaneously locks the drum. An automatic sowing apparatus can be fixed at the back if desired. The chief advantages of the implement are that it will ride easily over stony ground or slash, owing to the large diameter of the drum, and that all parts subject to wear are detachable. It has been successfully used for two years in various parts of Norway, and has met with general approval. With one horse and one man, 5–12 dekares can be dealt with in a day.

23.23. Sowings

23.23.1. *Seed Procurement, Treatment, and Testing*

23.23.1. SCHMIDT, W. Die Bedeutung der Keimschnelligkeit für den Aussaatwert des Samens. **[The significance of speed of germination in relation to the value of the seed for sowing.]** *Z. Forst- u. Jagdw.* 72, 1940 (35–47). [G.]

It is often desirable to know the speed of germination of a given seed lot, as well as its germination capacity. The author suggests that in the case of Pine seed, 'speed of germination' be defined as percentage of germination after 4 days under standard testing conditions—germination capacity being the percentage of germination obtained after 7 days. He arrived at a fairly accurate estimate of 'speed of germination' and germination capacity using M. Kuznetsova's seed-testing method for conifers based on the starch reaction (*Lesnoe Khozyaystvo, Moscow*, June 1939). The Pine seed was soaked on blotting paper for 18 hours at room temperature and was subsequently left for 24 hours in a germinator at 25° C. Then the embryos were excised and placed for 2 hours in a solution of iodine-potassium iodide (·3 g. iodine and 1·3 g. potassium iodide to 100 c.c. water). The percentage of embryos which became dark-coloured corresponded to the 'speed of germination' as determined by sprouting, while the percentage of dark-coloured and light-coloured embryos corresponded to the total germination capacity.

23.23.1 : 21.5 (54.2). RAYNOR, E. W. **A preliminary guide to the germinative capacity in the United Provinces of seeds of certain common species and a few exotics, together with estimates of quantities of seed required per 1,000 plants.** *Bull. U. P. For. Dep.*, No. 14, 1940. pp. 20.

This bulletin has been prepared from all available data collected at the Central Nursery at Clutterbuckganj over a period of about 8 years and full use has also been made of the Forest Research Institute publication on 'Seed weights, plant per cents. &c. for forest plants in India' [*Indian For. Rec. (n.s.) Silviculture* 2, 5, 1937]. Altogether 20 species are dealt with.

23.23.1 : 23.26.1. SHUMILINA, Z. K. **General methods of stratification for the seed of tree and shrub species.** *Lesnoe Khozyaystvo, Moscow* 1940 (2), (32–6). [R.]

23.23.1 : 23.26.1. SHUMILINA, Z. K. **The stratification of the seed of different forest species.** *Lesnoe Khozyaystvo, Moscow* 1940 (3), (35–8). [R.]

The first paper outlines the main principles evolved from Russian and foreign experience. There is a large amount of evidence for the superiority of peat as a stratification medium. Where peat is unobtainable, pure, washed sand should be employed. The moisture should be high until the seed swells: water should exude from sand, and from peat on slight compression. After the swelling of the seed and until the end of the stratification process the moisture content of the medium should correspond to 40–45 per cent. of its maximum water-holding capacity so as to admit sufficient air. Temperature requirements during the stratification process vary for the different species. Under Russian conditions, temperatures from 0° to 10° C. are

obtained in cellars (stratification in boxes) or in warm winter trenches protected from freezing; higher stratification temperatures are obtained in summer trenches, and lower temperatures either under snow, in boxes or otherwise, or else in winter trenches subject to freezing. The rest of the article deals mainly with stratification trenches as recommended for Russian nurseries.

The second paper is a summary of stratification technique evolved by different workers, including the author herself, for the following species: *Pyrus malus* and *communis*; *Prunus cerasus, spinosa, domestica, divaricata,* and *armeniaca*; *Acer tataricum, platanoides, saccharinum, negundo,* and *pseudoplatanus*; *Fraxinus americana* and *excelsior*; *Corylus avellana*; *Juglans regia, manshurica, cinerea,* and *nigra*; *Elaeagnus angustifolia*; *Cornus sanguinea* and *alba*; *Sorbus aucuparia*; *Lonicera tatarica* and *xylosteum*; *Amelanchier vulgaris*; *Tilia parvifolia*; *Euonymus verrucosus*; *Sambucus racemosa* and *nigra*; *Hippophaë rhamnoides*; *Rhus cotinus*; *Crataegus oxyacantha*; *Rosa canina*; and *Phellodendron amurense.*

23.23.1 : 12.2. HEIT, C. E. **Germination of Sugar Maple as correlated with seed treatment.** *Notes For. Invest.* No. 34, 1939. pp. 2.

Best results were obtained by broadcast sowing in the fall soon after collection, to a depth not greater than 1 in. and under a heavy mulch. Stratification at 36°–40° F. for a period of 50–75 days is a necessary pre-treatment to spring sowing.

23.23.1 : 12.2. ELIASON, E. J. **The storage of White Ash seed.** *Notes For. Invest.* No. 30, 1939. pp. 3.

The best conditions for the storage of White Ash seed appear to be low constant temperarure, and the maintenance of a low moisture content by sealing.

23.23.1 : 12.2. ROHMEDER, E., and LOEBEL, M. Keimversuche mit Zirbelkiefer (*Pinus cembra*). **[Germination tests with *Pinus cembra*].** *Forstwiss. Cbl.* 62, 1940 (25–36). [G.g.] [Forschungs- und Prüfstelle für forstliches Saatgut, Munich.]

A report on experiments undertaken at Munich since 1936. Although the thick seed coat did not stop the penetration of sufficient water for germination, this was favoured by placing the seed in concentrated sulphuric acid, thus reducing the thickness of the seed coat so that there was less resistance to the passage of oxygen and to the growing radicle. Dessication of seed in dry storage frequently resulted in loss of germination capacity. The most suitable method of storage and pre-treatment was found to be stratification of the seed in wet peat dust at 2° C. during the entire period between harvest and sowing in the following spring. The fact that the embryos had not yet reached full size when the otherwise mature seed was harvested, and would not do so until after a period of after-ripening, was a frequent obstacle to germination. The after-ripening period was shortened by the cold and wet storage. Sometimes *P. cembra* seeds germinated more quickly and in larger proportions in the dark than in daylight.

23.23.1 : 12.2. MAKI, T. E. **Significance and applicability of seed maturity indices for Ponderosa Pine.** *J. For.* 38, 1940 (55–60). [Intermountain Forest & Range Exp. Sta.]

A method for determining the maturity of freshly picked cones by means of specific gravity determinations is described. The point at which Ponderosa Pine seed appears to reach an acceptable self-extraction and germinative capacity percentage is in the neighbourhood of a mean cone specific gravity value of 0·85. Kerosene is recommended as a suitable test liquid for general use in central Idaho.

In the tests carried out the specific gravity of Ponderosa Pine cones dropped from 0·92 on 27th July to 0·74 on 5th September. In the same period the percentage of self-extracted seed rose from 0 to 91·6 per cent. and the germination capacity rose from 0 to 74·1 per cent. Great care should be taken to determine the proper time of cone harvest as this vitally affects the germinative capacity of the seed.

23.23.1 : 12.2. ELIASON, E. J. **Storage of Eastern White Pine seed for seven years.** *Notes For. Invest.* No. 29, 1939. pp. 2.

Tests confirm the value of air-tight, and low constant temperature storage of conifer seed in maintaining viability. White Pine seed stored in sealed carboys, in a seed vault having a temperature of 36–38° F. and 85–90 per cent. relative humidity, showed 87 per cent. germination at the end of seven years.

23.23.1 : 12.2. ELIASON, E. J., and HEIT, C. E. **The size of Scotch Pine cones as related to**

seed size and yield. *J. For.* 38, 1940 (65–6). [New York State Conservation Department.]

A shipment of Scotch Pine cones, which showed a wide variety in the size of individual cones, was divided into four length classes, each class being oven-dried, extracted and tested separately. From this study it was determined that (1) there is a definite relationship between the size of an individual cone and the size and number of seed, the larger the cone the larger the seed and greater the number of seeds; (2) on a volume basis the smallest cones produced as many viable seeds as the largest cones; (3) the seed from larger cones produced the largest trees; (4) the seed from the smallest cones not only produced the smallest trees but also the fewest trees per gram of seed sown. Cones less than $1\frac{1}{2}$ in. long are a relatively poor source of seed.

23.23.1 : 12.2. HOLDRIDGE, L. R. **A rapid method of extracting Balsa seed.** *Carib. For.* 1 (2), 1940 (25). [E. span.]

Seed of *Ochroma pyramidale* (Cav.) Urban (*O. lagopus* Sw.) was successfully cleaned of its floss by placing the uncleaned mass on a wire sieve of $\frac{1}{8}$ in. mesh and setting fire to it. The fire flashes across and the seeds drop through the meshes. There is apparently little or no damage to the seeds; on the contrary, the process seems to hasten germination and raise the germination percentage. The best results were obtained when the seeds were allowed to drop through into a pan of water 2 in. below the screen.

23.23.1 : 21.5 : 12.2. HEIT, C. E. **Field germination and propagation of White Oak.** *Notes For. Invest.* No. 33. 1939, p. 1.

Best results were obtained by collecting seed as soon as it fell to the ground, sowing it in the fall, and applying a fairly heavy mulch of leaves to prevent freezing of the radicle.

23.23.3. *Methods of Sowing*

23.23.3 (47.3 : 47.6). MATYAKIN, G. I. **On the possibility of establishing trees and shrubs in the Steppe by direct sowing.** *Dokl. vsesoyuz. Akad. s.-kh. Nauk* No. 21/22, 1939 (60–3). [R.] A.P.B.

Encouraging results are reported from preliminary experiments with different species at two stations of the chernozem zone during 1937–8.

23.23.3 : 12.2 (75.8). WALLACE, W. G. **Direct seeding of Longleaf Pine indicated as a practical method of reforestation.** *J. For.* 38, 1940 (289). [Georgia Department of Natural Resources.]

Various method of spot seeding of Longleaf Pine in Georgia have proved successful experimentally although broadcast seeding was a complete failure. Seeding should be done from November to January. Seed damage may be caused by rodents and birds, especially doves.

23.23.3 : 12.2. POPE, C. T. **Direct seeding methods for Scotch Pine.** *Notes For. Invest.* No. 25, 1939. pp. 2.

Light soil treatment such as raking proved most efficient as it increased the catch and at the same time maintained protective vegetation. Two hundred large seed spots (4–6 ft. in diameter) per acre gave more uniform results than the regulation method (1 × 1 ft.). Uniform stocking and good vigour were obtained from line seeding in narrow, shallow furrows, and shallow spade slits (1–$1\frac{1}{2}$ in. deep) gave a good seedling catch. Sowing on snow was unsuccessful. Seedling catch was good on moss-covered moist areas, and size of seedlings varied directly with quantity of available moisture.

23.23.3 : 12.2. SCHOPMEYER, C. S. **The use of Western Red Cedar in reforestation by direct seeding.** *Res. Note Nth. Rocky Mt. For. & Range Exp. Sta.* No. 5, 1940. pp. 4.

According to first-year results from 3 sites in Idaho, direct sowing in spots without protection from rodents appears possible. Autumn sowing gave higher survival than spring sowing.

23.23.3 : 45.1. SCHOPMEYER, C. S. **Successful forestation by direct seeding using poisons for rodent control.** *Res. Note Nth. Rocky Mt. For. & Range Exp. Sta.* No. 1, 1940. pp. 5.

Two broadcast-burned areas in Washington and Idaho, containing a fair rodent population, were poisoned with hulled sunflower seed treated with thallium sulphate at the rate of 1 part Tl_2SO_4 to 100 parts of seed by weight, and 1 pound of bait per acre, about one week before sowing. In addition the Western White Pine seed to be sown was coated with a poisonous mixture containing approximately 48 per cent. yellow dextrine, 34 per cent. plaster of paris, 15 per cent. corn meal, and 3 per cent. strychnine alkaloid. The germination and

first-year survival figures obtained proved this method to be both practical and economical.

23.24. Formation of Crops (Stands) by Planting

23.24.1. *Planting Material. Age and Size of Plants*

23.24.1 : 12.2. LITTLEFIELD, E. W. **A plantation of native Tamarack.** *Notes For. Invest.* No. 28, 1939. p. 1.

The relatively thrifty trees of a ten-year-old plantation of *Larix laricina*, on poorly drained ground, showed an average height of 12–15 ft. The wild seedlings used for planting were obtained from a bog.

23.24.1 : 12.2. LITTLEFIELD, E. W. **Planting results with 1–0 Scotch Pine and Jack Pine compared with 2–0 seedlings and transplants.** *Notes For. Invest.* No. 26, 1939. p. 1.

The following results were noted at the end of the fifth growing season:—

	Scotch Pine		*Jack Pine*	
Planting stock	*Per cent. survival*	*Average height*	*Per cent. survival*	*Average height*
1–0	67	2·2	59	2·0
1–0*	82	2·4	57	3·1
2–0	92	3·9	83	4·2
2–0*			87	5·3
1–1			98	6·1
2–1	88	3·5		

* From fall-sown nursery beds.

23.24.1 : 12.2 (91.4). CHINTE, F. O. **Efficiency of some packing materials on conserving the vitality of bare-rooted Narra seedlings.** *Philipp. J. For.* 2, 1939 (317–27). [Bureau of Forestry, Philippines.]

Narra (*Pterocarpus* spp.) seedlings are usually shipped with bare roots and to ensure safety in transit they must be packed in materials which are moisture conservers. Investigation shows that the three packing materials leaf-mould, sawdust and rice-hull are all efficient in conserving moisture and that seedlings of Narra can be sent to any part of the Philippines without appreciable loss if properly packed in one of these materials. Reduction in percentage of survival is found to be roughly proportional to the natural loss of moisture in the packing media.

23.24.1 : 56 : 12.2. HOFFMANN, R. Die Abhängigkeit des Höhenwachstums der Pappelheister von Durchmesser der Steckhölzer. **[The dependence of the height growth of Poplar saplings upon the diameter of the cuttings.]** *Forstwiss. Cbl.* 62, 1940 (20–1). [G.]

The height growth of the saplings depended among other factors [cf. *For. Abs.* 1 (38)] on the diameter of the cuttings; those of approximately 15 mm. diameter gave taller saplings than either thinner or thicker cuttings.

23.26. Plant Rearing. Nursery Practice

23.26. CHAPMAN, R. A. **A method for inventorying planting stock in forest nurseries.** *Occ. Pap. Sth. For. Exp. Sta.* No. 86, 1939. pp. 10. [Southern Forest Exp. Sta.]

The method consists of an estimate by sampling of the total number of seedlings and of the percentage of plantable seedlings.

23.26 (71.1). WELLS, T. **Nursery practice at the Green Timbers Forest Nursery.** *For. Chron.* 16, 1940 (94–8).

Mass production of nursery stock has brought about the extensive use of mechanical methods, the technique for which is here described. The collection and extraction of seed, the preparation of seedbeds, watering, weeding, winter protection, root pruning, and shipping of stock are discussed. The total cost per thousand trees varies from $1·70 for 1–0 stock to $3·00 for 2–0 stock, the latter price f.o.b. the nursery and including packing and lifting.

23.26 : 07.7. SWART. Pflanzenzucht und Pflanzung im Dienste der Leistungssteigerung. **[Plant raising and planting in the service of increased yields.]** *Z. Forst- u. Jagdw.* 72, 1940 (65–87). [G.g.]

'Radex', a machine invented by the author for the under-cutting of roots of nursery seedlings, is described. It closely resembles a small cultivator and its working parts consist of two circular knives mounted so as to form an acute angle when their lowest points touch. So far, two types have been evolved: a heavy machine (diameter of the knives 50 cm.) drawn by a horse, and a lighter one (diameter of the knives 40 cm.) drawn by two men. Evidence based on large-scale experiments during 1934–9 under the auspices of the A.T.F. (German committee for technical forestry matters), the Eberswalde Botanical Institute, and the Reichsforstamt, is submitted to show that (1) in the

case of large nurseries, the use of 'Radex' is cheaper than lining out, and (2) under-cutting with 'Radex' produces more vigorous plants than does transplanting. The paper also includes an exposé of the author's views on tree breeding and nursery work in general.

23.26.1. *Description of Different Nursery Methods*

23.26.1 : 21.5 : 23.24.1. BRASNETT, N. V. **Stump planting.** *E. Afr. agric. J.* 5, 1940 (387–8).

In Uganda, *Chlorophora excelsa*, all the Mahoganies (*Khaya* and *Entandrophragma*), *Maesopsis eminii*, *Afzelia*, *Daniellia*, &c. can be established from stumps, as also can several of the more commonly used exotics, e.g. *Cassia siamea* and *Azadirachta indica*. A root length of 9–10 in. and as short a stem as possible seem best for most species, including Mahogany, but stems of 9–12 in. have been used with greater success than short ones for *Cassia siamea* on soils liable to waterlogging. Diameters of 3–4 in. have done the best in difficult situations. From an economic viewpoint, the problem is to determine to what extent establishment and tending costs, especially in the case of planting in existing forest, can be reduced by using the more expensive large stumps.

23.26.1 : 23.24.2–3 : 21.2. JACKSON, T. H. **Note on a method of raising seedlings for arid districts.** *E. Afr. agric. J.* 5, 1940 (363).

Pots are made from bamboos of not less than 2 in. internal diameter, cut into sections 20 in. long, one end of each section being cut just below a node to provide a bottom in which a hole $\frac{3}{4}$ in. in diameter is bored. The bamboos are then split lengthwise, and one-half of each section soaked for several hours in a $1\frac{1}{4}$ per cent. solution of sulphate of ammonia. When re-assembled by wiring, each pot has one treated and one untreated half. As soon as the seedlings are large enough to handle, they are transferred to these pots, which are previously filled with a good potting mixture. Planting spots are prepared by digging and manuring. In planting, the halves of the pot are separated by cutting the wires. The roots of the seedling will then be found to cling to the treated half, which is inserted with the plant into a crowbar hole, thus avoiding damage to the roots. The hole is then filled and the soil firmed in the usual way.

23.26.2. *Rearing of Individual Species*

23.26.2 : 34.25 : 12.2. WIGG, L. G. T. **The production of field plants of the Clove Tree.** *E. Afr. agric. J.* 5, 1940 (268–78).

23.26.5. *Treatment with Growth Substances*

23.26.5 : 21.5. HUBERT, B., and RAPPAPORT, J. Invloed van para-phenyleendiamine op de beworteling van stekken. **[Influence of para-phenylene-diamine on the rooting of cuttings.]** *Natuurwet. Tijdschr.* 21, 1939 (56–62). [Flem.e.] L.S.

The rooting response of cuttings of several woody species was stimulated by a 15- to 18-hour treatment with very dilute solutions (100–1,000 mg. per l.) of para-phenylene-diamine. Optimum curves were obtained by plotting the number of roots against varying concentrations of the substance, the optimum varying with the individual species. Concentrations above the optimum decreased the number of roots and damaged the base of the cuttings. Thus the effects of this substance resemble those of β-indole-acetic acid, but no claim is made that the similarity of the processes involved is necessarily more than superficial. Further experiments are to be carried out with the ortho- and meta- isomers of para-phenylene-diamine.

23.26.5 : 21.5 : 12.2. GRACE, N. H. **Vegetative propagation of conifers. IV. Effects of cane sugar, ethyl mercuric phosphate, and indolylacetic acid in talc dust on the rooting of Norway Spruce.** *Canad. J. Res.* 18, Sec. C, 1940 (13–7). [National Research Laboratories, Ottawa.] P.R.

Norway Spruce cuttings collected in November from the upper part of the tree were treated with a series of talc dusts containing indolyl-acetic and naphthyl-acetic acids, each at 0, 1,000, and 5,000 p.p.m., combined with cane sugar at 0 and 10 per cent., and ethyl mercuric phosphate at 0 and 50 p.p.m., and propagated in a greenhouse. Indolyl-acetic acid at 1,000 p.p.m. increased rooting by about 10 per cent. to 42·5 per cent. three months after planting, but at 5,000 p.p.m. reduced it significantly. Naphthyl-acetic acid reduced rooting at both concentrations. Indolyl-acetic acid increased the length of root per rooted cutting. Sugar in combination with indolyl-acetic acid inhibited the increase in root length

caused by the hormone alone; organic mercury alone or in combination with indolyl-acetic acid reduced root length but sugar and mercury in combination exerted no greater inhibition than either alone. Mean root length was affected only by indolyl-acetic acid, which increased it. *Author's summary.*

23.26.7. *Damage in Nurseries and Methods of Protection*

23.26.7 : 11.16 : 12.2. JACKSON, L. W. R. **Lightning injury of Black Locust seedlings.** *Phytopathology* 30, 1940 (183–4). [Division of Forest Pathology, Bureau of Plant Industry.]

In a New Jersey forest nursery, first-year seedlings of *Robinia pseudoacacia* that had just emerged were partly killed and partly injured by lightning, which entered the field from an electric pylon. Examination of the injured plants showed that the deeper roots had been killed, though there were no marked internal symptoms and the stem and leaves showed no external symptoms of injury. Isolations from the injured roots yielded none of the known parasitic fungi. Most of the seriously injured plants stayed dwarfed and more or less chlorotic, and either died or were of no use for planting. It is thought that lightning damage might be the explanation of other sudden seedling losses in forest nurseries.

23.26.7 : 11.2 : 11.4. MAŘAN, B. **A micro-climatic and pedological study in forest nurseries.** *Lesnická Práce* 18, 1939 (563–86). [Cz.g.f.]

Variations of both temperature and humidity were smaller in covered seedbeds than in the uncovered controls.

23.26.7 : 12.2. ELIASON, E. J. **Further comments on arsenic burning.** *Notes For. Invest.* No. 32, 1939. pp. 2.

Red Pine seedlings planted in soil that had been treated with different concentrations and forms of arsenic, invariably produced red tips and the toxic effect of the arsenic appeared to increase a few years after applications were made. Relatively high concentrations of arsenic resulted in a complete browning of the needles from the tips backward and subsequently in the death of the seedling.

23.26.7 : 13.2 (74.7). ELIASON, E. J. **One method of White grub control.** *Notes For. Invest.* No. 31. 1939, p. 1.

At the Saratoga nursery the species of white grub doing most damage is *Polyphylla variolosa*, which may become concentrated in certain spots. A practical control is the application of paradichlorobenzene to the soil at the rate of 400–500 lb. per acre. The best time for treatment is in the summer while ploughing, and seed should not be sown until the following spring.

23.26.7 : 13.2 (75.6–7). JOHNSTON, H. R., and EATON, C. B. **White grubs in forest nurseries of the Carolinas.** Bureau of Entomology & Plant Quarantine, U.S. Department of Agriculture No. E–486. 1939. pp. 8. [Division of Forest Insect Investigations, Bureau of Entomology & Plant Quarantine.]

In forest nurseries of the south-eastern U.S., the feeding of white grubs (*Phyllophaga* spp.) on the roots of young tree seedlings results in a heavy loss in the annual production. Southern Pines, notably Longleaf, Shortleaf, Loblolly, and Slash Pines, suffer the most severe injury, although attacks on various hardwoods have been noted. Carbon disulphide injected into the soil at the rate of 1 pint per 100 sq. ft. seems to be the best available means of control. Protection may be secured at a cost of slightly over 4 cents per 1,000 plants, exclusive of the cost of labour for application of the chemical. *From authors' summary.*

23.26.9. *Other Methods of Manuring or Fertilizing*

23.26.9 : 21.3 : 12.2. DEMORTIER, G., and FOUARGE, J. Recherches sur l'alimentation azotée, phosphatée et potassique des semis de Pin sylvestre (*Pinus silvestris* L.). [**Research on nitrogen, phosphate, and potash, as fertilizers for seedlings of Scots Pine (*P. sylvestris*).**] *Bull. Inst. agron. Gembloux* 7, 1938 (173–93). [F. flem. g.e.] L.S.

Pot experiments on the fertilizing of Scots Pine seedlings with ammonium sulphate, sodium nitrate, dicalcium phosphate, and potassium chloride showed that (*a*) the seedlings had a definite need of nitrogen and phosphate; (*b*) they responded far less to potash; and (*c*) nitrogen as ammonium sulphate was much more favourable than as sodium nitrate. The experiments are preliminary only, and no indication can yet be given of the correct doses for nursery application. *From authors' summary.*

23.27. Arboriculture

23.27 (77.3). DAVIS, J. E. **Planting and care of shade trees.** *Circ. Ill. nat. Hist. Surv.* No. 36, 1940. pp. 23.

23.5. *Underplanting. Nurse Trees*

23.5 : 11.44 (43.1–5). SCHNEIDER, B. Untersuchungen über den Einfluss des Unterbaues auf den biologischen Zustand des Auflagehumus im nordwestdeutschen Kieferngebiete. [**Research on the influence of underplanting on the biological condition of the surface humus in the Pine region of north-west Germany.**] *Z. Forst- u. Jagdw.* 72, 1940 (87–126). [G.g.]

Experiments and observations with different species on podsolized diluvial sands and clayey soils showed that Beech was quite unsuitable for underplanting in the Pine region of north-west Germany. The Beech roots penetrated very slowly into the deeper and less lime-deficient soil layers, the Beech leaves had a low calcium and a high silicic acid content, and both the depth and the acidity of the surface humus were increased. The humus had a high carbon content and was very compact in its lower strata. A few years following underplanting the ground vegetation was completely suffocated and the activity of Hymenomycetes and other decomposition agents was reduced. The underplanting of Bird Cherry, the roots of which grew very quickly into the deeper soil layers, resulted in most satisfactory surface humus conditions, but owing to certain disadvantages of that species, such as its excessive susceptibility to damage by deer, the author does not recommend the creation of understoreys of pure Bird Cherry. Instead he advocates the use of a mixture of species. In the district studied, a combination of Bird Cherry, Birch, Mountain Ash, Maple, Oak, and Beech gave a very loose, well-mixed humus bearing a fine moss vegetation. The thickness of this surface humus did not increase during 14 years following underplanting.

23.5 : 23.21 (931). HOCKING, G. H., and MAYFIELD, A. G. K. **Interplanting with exotics at Erua State Forest.** *N.Z. J. For.* 4, 1939 (218–26).

Interplanting of cut-over Podocarp forest with shade-bearing exotics has been carried out under a wide range of cover conditions. *Thuja plicata* has proved the most suitable species so far; *Pseudotsuga taxifolia* and *Tsuga heterophylla* show promise; *Cupressus lawsoniana* is attacked by *Armillaria mellea*. Present results indicate that, provided large stock is used and there is no delay between logging and planting, exotics can be successfully established without preliminary preparation or subsequent liberation. *From authors' summary.*

23.5 : 34.25 : 12.2 (67.6). THOMAS, A. S. **Shade trees in Uganda and their relation to the cultivation of Coffee and Tea.** *E. Afr. agric. J.* 5, 1940 (287–93). [Department of Agriculture, Uganda.]

23.6. *Tending of Plantations*

23.6 : 24.1 : 07.7. COOK, D. B. **A useful forest tool.** *J. For.* 38, 1940 (63). [Civilian Conservation Corps.]

A cutting hook for cleaning and weeding, made by breaking off the end of a sickle to leave a blunt-ended blade with about 9 in. of cutting edge. The tool will cut stems up to 2 in. diameter, weighs 9 oz., and is safer to use than an axe or a machete.

23.6 : 12.2 (54.8). GRIFFITH, A. L. **An investigation into the relative merits and costs of five different weeding methods in the formation of Teak (*Tectona grandis*) plantations in areas having a West Coast type of climate.** *Indian For. Rec.* (*n.s.*) *Silviculture* 4, 1939 (iv + 97–132).

Four large-scale experiments covering approximately 2 acres each show that of the 5 methods tried, weeding by scraping in 4 ft. strips is the method which gives the most beneficial results at the most reasonable cost. The relatively expensive weeding by forking in 4 ft. strips is in no way justified by its results and the cheap weeding by weed cutting alone is not worth while as it results in poor height growth at a time when vigorous height increment is essential.

The experiments were undertaken at Nilambur (South Malabar district), Dhoni (Palghat division), Mount Stuart (South Coimbatore division) and Walayar (Palghat division), in places having a general west coast type of climate with an average annual rainfall varying from 60 to 120 inches and at elevations varying from the plains up to 3,000 ft. The soils at all centres are light forest soils naturally well aerated. The weed conditions of the experiments are described in the paper. *From author's summary.*

24. TENDING OF STANDS AND TREES

24.2. *Thinnings*

24.25 : 12.2. CHANDLER, W. G. **Thinning experiments in Jarrah coppice (*Eucalyptus marginata*).** *Aust. For.* 4, 1939 (69–78).

This is a progress report of a study commenced in 1935. The degree of thinning, in the form of a reduction in the number of stems per stump, has been studied, together with its effect on the growth, development, and form of the residual shoots. In good quality forest thinning has so far failed to produce any effect on either the height or diameter growth of the remaining shoot or shoots. In other areas while there has been no effect on height growth there has been an increased girth increment in the thinned shoots. There is no record of an adverse effect of early coppice thinning on either growth or form. *Author's summary.*

24.25 : 12.2 (78.6). FAHNESTOCK, G. R., and WELLNER, C. A. **Early effects of thinning pure Ponderosa Pine in western Montana.** *Res. Note Nth. Rocky Mt: For. & Range Exp. Sta.* No. 3, 1940. pp. 3.

Thinnings from below in young stands of Ponderosa Pine stimulated diameter and basal-area increment over a five-year period following the operations, but had no consistent effect on height growth. The vigour of the stands appeared to be improved by heavy thinnings, but on heavily thinned plots it seemed likely that some trees might become 'wolves' before closure was re-established. The data are summarized in a table.

24.3. *Opening of the Canopy. Release and Improvement Cuttings*

24.3 (75.3–7 : 76.8–9). BUELL, J. H. **Some results of a study of the crop tree method of timber stand improvement.** *Tech. Note Appal. For. Exp. Sta.* No. 41, 1940. pp. 2.

Miscellaneous recommendations are made on release cuttings and crop-tree selection in young mixed-hardwood stands in the Southern Appalachian region, based on a study of stand-improvement work carried out by the C.C.C.

24.4. *Shelterbelts. Windbreaks*

24.4 : 23.21 (47.6). BODROV, V. A. **Present-day management problems in mature shelterbelts.** *Lesnoe Khozyaystvo, Moscow* 1940 (3), (19–25). [R.]

From observations in the Kamennaya Steppe (Voronezh, Southern Russia), there is no evidence that the Oak growing in shelterbelts is less long-lived than otherwise, and the question of Oak regeneration is not urgent. However, many shelterbelts are composed of species which, under the given shelterbelt conditions, are about to reach their maximum age. In particular, regeneration or replacement of the Birch belts over 40 years old, which do not have an understorey, should be started at once. This should be handled very carefully so as not to upset even temporarily the beneficial effects of the shelterbelts. In the author's opinion the Birch trees can be maintained for another 20 years during which they can be replaced by Sycamores to be sown after proper preparation of the soil.

24.5. *Pruning*

24.5 : 12.2. MEGINNIS, H. G. **Effect of top pruning on survival and early growth of Black Locust.** *J. For.* 38, 1940 (30–6). [Southern Forest Exp. Sta.]

This study indicates that the top-pruning of Black Locust planting stock is a practice of doubtful value, which may produce undesirable results and should not be undertaken except to salvage top-damaged or poorly formed seedlings. Severe pruning and pruning after growth has started should be avoided in all cases.

3. FOREST UTILIZATION. FOREST TECHNOLOGY

3 : 01 (213). **List of publications on tropical woods in the catalog of the Forest Products Laboratory Library.** Forest Products Laboratory, Madison, Wisconsin. May 12, 1939. [6 pp. typescript.]

3 : 07 (71). CANADA. **The Forest Products Laboratories, Dominion Forest Service. Program of work 1939-1940.** Forest Products Laboratories, Ottawa. pp. 87.

31. PROPERTIES AND ANATOMY OF WOOD

31 : 01 : 98.3 (73). **Foreign woods imported into the United States.** U.S.D.A. Forest

Service, Division of Forest Products, Washington, D.C. 1939. pp. 17.

List of woods and partial list of dealers.

31 : 33 : 12.2. BETTS, H. S. **American woods.** U.S.D.A. Forest Service, Washington D.C. 1939. [Division of Forest Products.]

Six pamphlets which are part of a series, each giving briefly the description, nomenclature, distribution and growth, supply, production, properties, and principal uses of one of the commercial forest tree species of the United States. These six pamphlets deal with Western Larch (*Larix occidentalis*), Black Locust (*Robinia pseudoacacia*), Sitka Spruce (*Picea sitchensis*), Lodgepole Pine (*Pinus contorta*), Western White Pine (*Pinus monticola*), and Yellow Poplar (*Liriodendron tulipifera*).

31 : 33 (66.3–9 : 67.1–2). AINSLIE, J. R. **Substitutes from West Africa.** *Wood* 5, 1940 (30–4).

Softwoods, which make up 80 per cent. of the British timber imports, are arbitrarily classified into four utility categories represented by species or genera as (1) Pines, (2) Spruces, (3) Larches, and (4) Cedars, and the physical and technical properties of each category are listed. West African soft-hardwood species, which may be substituted for softwoods for general purposes, are classed as small or large trees under the four categories, and general average descriptions are given of their grouped characteristics.

31 : 38 (943). WATSON, C. J. J. **Queensland hardwoods for the engineer.** *Adv. Leafl. Qd. For. Serv.* No. 5, 1939. pp. 13. P.R.

A brief account of the qualities required in timber used for engineering works, followed by a description of the chief hardwoods (mostly Eucalypts) of Queensland and a tabular key for the identification of their woods.

31 : 24.2 : 12.2. FOUARGE, J. Analyse physique, mécanique et anatomique de bois de Pin laricio de Corse, *Pinus nigra* var. *calabrica* Schneid. (*Pinus laricio* var. *corsicana* Hort.). **[Physical, mechanical, and anatomical investigation of the wood of Corsican Pine (*P. nigra* var. *calabrica* Schneid).]** *Bull. Inst. agron. Gembloux* 7, 1938 (361–95). [F. flem. g.e.] L.S.

Details are given of an investigation of the physical, mechanical, and anatomical characters of Corsican Pine logs grown in Belgium. The test results are tabulated in full. It was concluded that (i) Corsican Pine ranks among conifers as a good medium-quality wood; (ii) in one and the same stem, taking no account of the breadth of annual rings, quality decreased from butt to top and from the outer to the inner portion of the log; (iii) the higher the density and the narrower the annual rings, the better the physical and mechanical properties of the wood; (iv) to secure the production of high-grade wood, stands should be managed so as to obtain regular annual increments, young stands should be kept dense, and thinnings should be light and frequent at first, gradually becoming heavier and more widely spaced; the optimum breadth of annual rings has not yet been determined, but may possibly be of the order of 2–2·5 mm. *From author's summary.*

31 : 33 : 12.2. **The properties of Australian timbers. Southern Sassafras (*Atherosperma moschatum* Labill.).** *Mon. News Lett. Div. For. Prod. Aust.* No. 98, 1940 (4).

31 : 33 : 12.2 (75–6). CRUIKSHANK, J. W. **The utilization of Dogwood in the lower South.** *J. For.* 38, 1940 (284–5). [Southern Forest Exp. Sta.]

The principal use for Dogwood (*Cornus florida*) is shuttle blocks for textile mills. In 1936 the 34 shuttle-block mills in the lower south consumed about 8,000 standard cords of Dogwood, which would represent a cut of about 16,000 cords. This wood costs between $12·50 and $20 per cord delivered at the plant.

31 : 33 : 12.2. **The properties and uses of Australian timbers. Grey Gum.** *Mon. News Lett. Div. For. Prod. Aust.* No. 97, 1940 (3).

Brief notes on the wood of *Eucalyptus major*, *E. propinqua*, and *E. punctata*.

31 : 33 : 12.2. **The properties and uses of Australian timbers. Yellowwood.** *Mon. News Lett. Div. For. Prod. Aust.* No. 96, 1940 (3).

Brief notes on the wood of *Flindersia oxleyana*.

31 : 33 : 12.2. WILSON, S. E. **The qualities and uses of Larch timbers.** *Quart. J. For.* 34, 1940 (10–16).

A discussion of the physical properties, characteristics, and uses of European Larch, and the supplies of, and market for, this species in Great Britain. It is suggested that percentage of late wood is a more important criterion

than width of annual ring in determining the strength value of wood.

31 : 12.2. **Bongossi, *Lophira procera* A. Chev. (Ochnaceae).** *Merkblätter über kolonial Nutzhölzer, Tharandt* No. 9, 1939 [?]. pp. 10. [G.] P.R.

31 : 12.2. Njabi, Afrikanischer Birnbaum, *Mimusops djave* Engler. **[Njabi, African Pearwood, *M. djave* Engl.].** *Merkblätter über koloniale Nutzhölzer, Tharandt* No. 8, 1939 [?]. pp. 8. [G.] P.R.

31 : 12.2 (7–8). RECORD, S. J., and HESS, R. W. **American woods of the family Moraceae.** *Trop. Woods* 61, 1940 (11–54).

Detailed descriptions of the gross and microscopic characters of the woods, accompanied by notes on their present uses and habitat, and the common names of the trees from which they are derived.

31 : 33 : 12.2. **Sugar Pine: its properties, uses and grades.** Western Pine Association, Portland, Oregon. 1940. pp. 53. [*A.I.A. File* No. 19, 1940 ed.]

Popular account of the wood of *Pinus lambertiana.*

31 : 33 : 12.2. **Idaho White Pine: its properties, uses and grades.** Western Pine Association, Portland, Oregon. 1939. pp. 64. [*A.I.A. File* No. 19, 1939 ed.]

Popular account of the wood of *Pinus monticola.*

31 : 12.2. **The properties of Australian timbers: Radiata Pine.** *Mon. News Lett. Div. For. Prod. Aust.* No. 99, 1940 (4–5).

31 : 33 : 12.2. MELL, C. D. **The properties and uses of Cenicero.** *Veneers & Plywood* 33 (11), 1939 (8–9). P.R.

The wood of Cenicero or Genesero [*Samanea* (*Pithecolobium*) *saman*], which has recently been introduced into the veneer trade, resembles that of Guanacaste (*Enterolobium cyclocarpum*). The heartwood is a handsome reddish brown; the sapwood, which in full-grown trees is very narrow, is light yellowish. The wood is relatively hard, heavy, strong, and tough, and does not suffer from seasoning defects; it is easily worked and is eminently suitable for veneering. In Central America it is preferred to all other woods for making wheels for ox carts. It is reported to be not very durable in contact with the soil. The wood is available in large dimensions and large figured crotches are obtainable. The natural range of the tree is in Central and South America and the West Indies.

31.1. *Form. Size. Structure. Anatomy. Indentification*

31.1 : 07.7. PEW, J. C., and SCHAFER, E. R. **Forest Products Laboratory springwood-summerwood measuring instrument.** Forest Products Laboratory, Madison, Wisconsin. 1938. pp. 11. P.R.

The instrument consists essentially of a stationary microscope mounted over a sliding stage that carries the disk of wood to be scanned. The stage has two measuring devices:—(*a*) a scale that records the circular area corresponding to the length of the radius traversed; and (*b*) a device that records a figure which, multiplied by a constant, gives the cumulative area of the zones of springwood or summerwood. Thus the percentage area of either component of the wood is readily obtained by a simple calculation based on the two readings. For great accuracy, a number of radii may be measured, but normally readings along four radii at right angles to one another should be sufficient.

31.1 : 12.11 : 12.14. HUBER, B. Das Siebröhrensystem unserer Bäume und seine jahreszeitlichen Veränderungen. **[The sieve-tube system of our trees and its seasonal changes.]** *Jb. wiss. Bot.* 88, 1939 (176–242). [G.g.] O.B.D.

A monographic study of the histology and seasonal changes of the sieve-tube tissue in a number of German forest trees. The bearing of the results on the theory of translocation is discussed.

31.1 : 12.11 : 12.14. JACCARD, P. Tropisme et bois de réaction provoqués par la force centrifuge chez des feuillus. **[Tropism and reaction wood provoked in some broadleaved trees by centrifugal force.]** *Ber. schweiz. bot. Ges.* 50, 1940 (279–84). [F.]

Two 3- to 5-year-old trees of each of the species: *Acer pseudoplatanus, Fraxinus excelsior, Tilia cordata,* and *Robinia pseudoacacia,* were grown in pots on a rotating table during the growing season of 1939. By the end of the experiment, the stems had bent in varying directions but none geotropically, while almost all the terminal shoots had turned towards the

centre of the table. Stronger growth and tension fibres in the newly formed ring on the side facing the centre of the table were clearly observed in *Acer*.

31.1 : 12.14. JACCARD, P. Sur les épaississements spiralés et les striations des parois des fibres, des vaisseaux ou des trachéides du bois et leur signification. **[On the spiral thickenings and striations of wood fibres, vessels, or tracheids, and their significance.]** *Ber. schweiz. bot. Ges.* 50, 1940 (285–92). [F.]

Striations similar to those of compression-wood tracheids occur occasionally in erect coniferous stems; they were observed by the author in *Pinus echinata*, *P. ponderosa*, and *P. contorta* on the tangential or the radial walls or both, and in both early- and late-wood tracheids, and were independent of dehydration. The significance of such striations, in common with many other cases of spiral thickenings and striations of wood fibres, vessels, and tracheids, is as yet unexplained, and it is suggested that they are determined by factors other than those which model the external morphology of plants.

31.1 : 12.14. FOWLER, W. F., and HARLOW, W. M. **Infra-red photomicrography reveals plant cell-wall structure.** *Paper Ind.* Feb. 1940. pp. 2. (Repr.) [New York State College of Forestry.] P.R.

In infra-red microphotographs of the sap-wood of *Pinus strobus*, stained with neocyanine, it was possible to distinguish clearly the primary cell walls and the true intercellular substance as separate components of the 'compound middle lamella'.

31.1 : 12.14 : 12.15 (76.4). GLOCK, W. S., and REED, E. L. **Multiple growth layers in the annual increments of certain trees at Lubbock, Texas.** *Science* 91, 1940 (98–9). [Texas Technological College.]

Trees sometimes formed several growth layers in one growing season and these layers were often indistinguishable from true annual rings. A feature of the locality is the frequent occurrence of severe late spring frosts, which often result in the formation of frost rings in the wood. From their nature, these injuries mark the onset of growth for any particular year and were thus found to be very valuable in detecting and dating the occurrence of multiple growth rings.

31.1 : 12.14 : 12.19.2. WATKINS, K. S. **Stem anatomy of chaparral shrubs.** *Bot. Gaz.* 101, 1939 (391–402). O.B.D.

31.1 : 12.11 : 12.14 : 12.2. MOISEEVA, M. N. **On the anatomical structure of *Acer* stems in relation to their phylogeny.** *Zh. Inst. bot. Akad. Nauk U.R.S.R.* No. 23 (31), 1940 (13–7). [Ukr. r.e.] A.P.B.

The author studied the anatomical structure of the stem of *A. campestre* L., *A. platanoides* L., *A. laetum* C.A.Mey., *A. negundo* L., *A. tataricum* Z., *A. monspessulanum* L., *A. pseudoplatanus* L., *A. velutinum* Boiss., and *A. trautvetteri* Medw. The results supported the opinion of Warsow and Poyarkova to the effect that the placing of *A. campestre* in the Pax system does not agree with the real genetic relations. This species has a number of anatomical characters in common with *A. platanoides* and *A. laetum*, such as latex in the bark, crystal-bearing parenchyma in the xylem, and homogeneous pith, and should therefore be included in the same group as *A. platanoides* and *A. laetum*. *A. pseudoplatanus*, *A. trautvetteri*, and *A. laetum*, which are closely related in Poyarkova's system, have a very similar pith structure.

31.1 : 12.14 : 12.2. BARGHOORN, E. S. **Origin and development of the uniseriate ray in the Coniferae.** *Bull. Torrey bot. Cl.* 67, 1940 (303–28). O.B.D.

At the beginning of secondary growth the rays in the stem are very low but considerably higher in the root, thus accounting in part for the greater abundance of ray tissue in the root. In secondary wood most new rays are formed by initials originating at the apex or sides of fusiform initials, commonly as isolated cells; segmentation of fusiform initials also occurs. Increase in height is accomplished by division of the ray initials, and by fusion of rays either laterally or vertically. Decrease in height takes place by the loss of initials and by splitting into smaller units. These changes take place independently of each other, often simultaneously even in the same ray. The cambial initials giving rise to radial plates originate in the same way as ray initials. It is recommended that the term 'albuminous cell' be dropped.

31.1 : 12.14 : 12.2. LUGOVOY, M. **A contribution to the technique of counting resin canals in the xylem of Pine.** *Zh.*

Inst. bot. Akad. Nauk U.R.S.R. No. 23 (31). 1940 (177–84). [R.e.] A.P.B.

The author describes two instruments designed by himself with a view to facilitating the counting of resin canals in Pine stems. These are a special microtome which cuts sufficiently thin sections of entire young Pine stems, and an automatic counting pencil. The injection of gelatine and Indian ink into the resin canals also improved the counting technique.

31.1 : 12.14 : 12.2. Gross, S. T., Clark, G. L., and Ritter, G. J. **Arrangement of the cellulose crystallites in ray cells of White Oak as determined by X-rays.** *Paper Tr. J.* 109 (23), 1939 (37–8). [University of Illinois, and Forest Products Laboratory, Madison, Wisconsin.] P.R.

By means of thin sections of White Oak ray cells, a specimen was built that enabled the determination of the arrangement of the cellulose crystallites by X-rays. The cellulose crystallites were found to deviate about 30° from the vertical cross-wise direction in the ray cells of White Oak, which arrangement is in general agreement with that found by microscopical means. This finding indicates that the ray cells of White Oak will shrink and swell considerably in their longitudinal and tangential directions, which is, also, in general agreement with the findings obtained by microscopical means. *Authors' summary.*

31.1 : 33.0 : 33.32 : 12.2 (91.4). Sibiran, F. L. **Fiber measurement studies of Anabiong.** *Philipp. J. For.* 2, 1939 (301–15). [Bureau of Forestry, Philippines.]

The average length of wood fibres from 7-year-old trees of *Trema orientalis* (L.) Blume was 1·1588 ± ·0175 mm. and thus compared favourably with that of Poplars commonly used in the U.S.A. for paper manufacture. Fibres were longer in bigger trees than in smaller ones and their length increased within the same tree from the pith toward the bark and was greater at the butt than at the top end.

31.1 : 31.21. Yatsenko-Khmelevsky, A. A., and Bregadze, N. N. Sur la détermination de la porosité du bois par moyen des mesures sous le microscope. **[On the determination of the porosity of wood by measurements made under the microscope.]** *C.R. Acad. Sci. U.R.S.S.* 25, 1939 (794–7). [F.] O.R.S.

A simple technique is described for estimating the porosity of wood by the so-called linear method. Measurements of the internal diameter of cells and vessels in transverse and tangential wood sections are read off along a line represented by the micrometer scale in the eyepiece. Vessel measurements are made at a lower magnification than those for individual cells. The measurements are repeated along a number of closely spaced lines, and from the measurements the total cavity area per unit area of wood is calculated as a percentage figure. Using a large series of samples of 4 different woods, this method was compared with the planimetric method and proved to give closely similar results, the observed differences being of the order of 1–2 per cent. A porosity determination by the linear method can be made in about 2 hours, whereas 12 hours are needed for a planimetric determination.

31.1 : 31.3. Rüdiger, W. Der Bau verholzter Membranen und ihr Verhalten in flüssigem Fluorwasserstoff. **[The structure of lignified membranes and their behaviour in liquid hydrogen fluoride].** *Papierfabrikant* 38 (3), 1940 (9–13). [G.] P.R.

Swelling preceded the dissolution of cellulose in liquid hydrogen fluoride for both Pine and Beech specimens. As a result of the swelling of cellulose the lignin structure of the membranes was disturbed, although the lignin itself did not swell.

31.2. *Physical Properties*

31.2. Lopotko, V. A. **On the physical and mechanical properties of the wood of branches and knots.** *Trud. lesotekh. Akad. Kirov.* No. 54, 1939 (43–5). [R.]

In Pine, Spruce, and Birch, branch specimens differed very little from stem specimens with regard to compressive strength and hardness. The knots were denser and harder than the stem wood but their resistance to compression along the fibres was lower.

31.2 : 33 : 01. **List of publications on mechanical properties and structural uses of wood and wood products.** Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 27. P.R.

31.2 : 01 (81). Brotero, F. A. Métodos de ensaios adotados no I.P.T. para o estudo das madeiras nacionais. **[Methods of testing adopted in the Instituto de Pesquisas**

Technológicas de S. Paulo for the study of native woods.] *Bol. Inst. Pesq. tecnol. de S. Paulo* No. 24, 1939. pp. 28. [Port.] P.R.

An account of standard methods of testing the physical and mechanical properties of woods, accompanied by a table setting out the results of 150 tests on various Brazilian woods.

31.2 : 12.2. LANGLANDS, I. **The physical and mechanical properties of Mountain Hickory (*Acacia penninervis*).** *J. Coun. sci. industr. Res. Aust.* 12, 1939 (277–80). Division of Forest Products Reprint No. 62. [Division of Forest Products, C.S.I.R., Australia.]

Tests on specimens from 5 trees are described and the results are discussed, tabulated and compared with data for several other species. For tool handles and sporting goods Mountain Hickory is superior to American Ash and Spotted Gum (*Eucalyptus maculata*), but it is inferior to American Hickory.

31.2 : 12.2. BARNARD, M. M., and LANGLANDS, I. **The influence of certain factors on the physical and mechanical properties of Alpine Ash (*Eucalyptus gigantea* Hook.)** *J. Coun. sci. industr. Res. Aust.* 12, 1939 (275–6). Division of Forest Products Reprint No. 61. [Division of Forest Products, C.S.I.R., Australia.]

Tests made on specimens from 100 41- to 116-year-old trees showed that the only factor having any marked influence on the static bending strength, as measured by the modulus of rupture, was the density, the denser wood being the stronger.

31.2 : 12.2. LIMAYE, V. D. **Strength tests of *Grewia elastica* Royle.** *Indian For.* 66, 1940 (219–22). [Forest Research Institute, Dehra Dun.]

Results of these tests are given in two tables, (1) physical and mechanical properties and (2) comparative suitability. The data are compared with figures for *Tectona grandis* and *Fraxinus americana*. The timber is hard, tough, stronger than Ash and easy to work, and is suitable for all sorts of tool handles.

31.2 : 12.2. PHILIPPIS, A. DE. Sul legno di Douglasia. **[On the wood of Douglas Fir.]** *Riv. for. ital.* 2, 1940 (24–31). [It.]

Results from the author's own determinations of physical properties of specimens from a 26-year-old tree from the Florence region are compared with those of other investigators.

31.2 : 12.2. KINGSTON, R. S. T. **Tests on small clear specimens of Red Tulip Oak (*Tarrietia argyrodendron* var. *peralata*).** *J. Coun. sci. industr. Res. Aust.* 12, 1939 (389–90). [Division of Forest Products, C.S.I.R., Australia.] P.R.

The physical and mechanical properties of the wood are tabulated.

31.22. Relation to Water, Air, Gases

31.22. FREY-WYSSLING, A. Die Anisotropie des Schwindmasses auf dem Holzquerschnitt. **[The anisotropy of shrinkage on transverse wood sections.]** *Holz* 3, 1940 (43–5) [G.g.]

This article is based mainly on the work of R. D. Preston (*Philos. Trans.* 224, 1934).

31.22 : 07.7. GREENHILL, W. L. **A constant moisture content room for timber.** *J. Coun. sci. industr. Res. Aust.* 12, 1939 (378–82). [Division of Forest Products, C.S.I.R., Australia.] P.R.

A description of the construction and of the method of conditioning and controlling a small room designed to bring timber to a definite constant moisture content. No attempt is made to maintain either constant temperature or constant relative humidity, but rather to maintain the correct relation between the two, to give a constant equilibrium moisture content. The swelling or shrinking of a sensitive wood element is used to control the conditions: if the air be too dry, suitable humidification is brought into play; if too wet, the relative humidity is lowered simply by heating. The need for either cooling or dehumidifying units is thus avoided. *From author's summary.*

31.22 : 07.7. GREENHILL, W. L. **Ten years of trouble-free service. Tests on the latest type of Blinker moisture meter.** *Aust. Timb. J.* 5, 1939 (665–6). [Section of Timber Physics, Division of Forest Products, C.S.I.R.]

Recent improvements have been made in the equipment for Blinker moisture meters, including a special power unit which uses two 1½-volt electric torch batteries. During a recent service test three Blinkers were in operation for 1,000 hours and neither the power units nor Blinkers showed the least sign of failure.

31.22 : 07.7. **The testing of timber for moisture content.** *Tr. Circ. Coun. sci. industr. Res. Aust.* No. 45, 1939. pp. 26.

The main types of electrical moisture meters, the factors affecting their use, and the precautions to be taken in using these instruments are discussed. A list of species correction figures for Australian timbers to be used with resistance-type electrical moisture meters such as the Blinker, is appended. In this list, Douglas Fir has been adopted as the standard.

31.22 : 07.7. SCOTT, M. H. **Electric moisture-in-timber meter.** *J. S. Afr. For. Ass.* 3, 1939 (100–2). [Division of Forestry, Union of South Africa.]

A brief discussion of methods of operating moisture meters and the way in which moisture measurements are recorded. The range of moisture content over which the meter works is from 5 to 25 per cent. so that determinations cannot be made on green timber. Correction figures must be used for different species and thicknesses, and, allowing for these, it has been found that, for wood up to 2 in. thick, the determinations may be 1·5 to 2 per cent. above or below the actual moisture content. Differences may be greater for thicker material.

31.22 : 07.7. GIBBS, R. D. **The determination of water in wood.** *Woodlands Rev.* 11 (1), 1940 (5–8). [McGill University, Montreal.]

Various methods that may be used for the estimation of water are discussed briefly and it is concluded that few of these are at all suitable for the estimation of water in wood. Some of the electrical methods appear promising. A number of electrical moisture meters are listed giving the names of the makers or dealers and remarks on type, range, size, &c.

31.23. Weight. Specific Gravity

31.23 : 12.2 (94). GREENHILL, W. L., and DADSWELL, H. E. **The density of Australian timbers. 2.—Air-dry and basic density data for 172 timbers.** *Pamphl. Coun. sci. industr. Res. Aust.* No. 92 (*Tech. Pap. Div. For. Prod. Aust.* No. 33), 1940. pp. 75. [Division of Forest Products, C.S.I.R., Australia.]

The various factors which must be taken into consideration when determining the density of a piece of wood are discussed; chief amongst these are the moisture content and the incidence of collapse. The advantages of using basic density [oven-dry weight/constant soaked volume] for purposes of comparison are pointed out. In the laboratory, basic densities and air-dry (12 per cent. moisture content) densities before and after reconditioning are determined, and a brief description is given of the procedures. Results and statistical data are tabulated for 172 timbers.

It is pointed out that there is a somewhat closer relationship between basic density and air-dry density after reconditioning than between basic density and air-dry density before reconditioning. This is due to the irregular occurrence of collapse, the widespread incidence of which is not generally recognized. Finally, results are presented to illustrate the type of density variation found within a single tree, the variation in different trees of the same species, and the use that can be made of the density variation between material of different species for identification purposes. *Authors' summary.*

31.24. Calorific Force

31.24. BERTRAND, G., and BROOKS, G. Pouvoir calorifique des bois et de leurs principaux constituents. **[Calorific force of woods and their chief constituents.]** *Le Génie Civil* 115, 1939 (423–4). [F.] P.R.

The calorific force of 18 woods, determined by Mahler's method and expressed as Cal. per kg. of dry woods, was as follows:—

Wood	*Calorific force of Trunk-wood*	*Branch-wood*
Lime	4,579	4,694
Field Maple	4,848	4,673
Sycamore	4,658	4,673
Ash	4,662	4,550
Hornbeam	4,927	4,885
Sweet Chestnut	4,734	4,680
Pedunculate Oak	4,551	4,568
Sessile Oak	4,622	4,583
Beech	4,579	4,546
Poplar	4,378	4,546
Aspen	4,061	4,655
Alder	4,715	4,500
Birch	4,802	4,648
Spruce	4,608	4,757
Larch	4,586	4,821
Maritime Pine	4,849	4,647
Scots Pine	4,556	4,809
Silver Fir	4,589	4,613

The extreme values observed (4,061 Cal. for Aspen and 4,849 Cal. for Maritime Pine) differ by about 20 per cent. In cases where the branchwood has a slightly higher calorific value it will clearly be even more than usually

desirable to use the branchwood for fuel and the trunkwood for timber. The ash per cent. varied between 0·25 in trunkwood of Scots Pine and 1·36 in the branchwood of Sycamore. Notes are also included on the calorific value of some of the constituents of wood.

31.25. Hardness

31.25–7. THOMAS, A. V. **The mechanical properties of timber.** *Malay. Forester* 9, 1940 (4–13).

A semi-popular review of the bases and methods of timber testing. The allowable working stresses for some common Malayan timbers are tabulated.

31.25 : 01. PALLAY, N. Ergänzende Angaben zum Holzhärte-Prüfverfahren nach Krippel. **[Supplementary data on Krippel's method of testing the hardness of wood.]** *Holz* 2, 1939 (413–16). [G.g.]

Krippel's method is discussed in the light of recent research by the author at Sopron, Hungary, and a close relationship is shown to exist in Spruce, Pine, Beech, and Oak between hardness across the grain ('Hirnhärte') and specific weight, and also between the latter and the so-called 'Seitenhärte', i.e. average hardness as determined on the radial and the tangential section. Since the same relationship exists between 'Hirnhärte' and 'Seitenhärte' as between compressive strength parallel to, and across the fibres, hardness as determined by this method also allows of conclusions regarding the compressive strength of the sample. Krippel's method is considered superior to Brinell's; Hoeffgen's apparatus is said to determine the approximate compressive strength of a sample instead of its absolute hardness; while Huber's method is shown to lead to approximately the same results as that of Krippel.

31.27. Mechanical strength and resistance

31.27 (54). LIMAYE, V. D. **The comparative strengths of some important Indian timbers and their uses.** *Indian For. Rec. (n.s.) Utilization* Vol. 1–A, 1939. pp. iii + 28. [Forest Research Institute, Dehra Dun.]

Data for 36 Indian species and for 6 species commonly imported to India.

31.27 : 11.11 : 12.2. THUNELL, B. Temperaturens inverkan på böjhållfastheten hos svenskt furuvirke. **[The effect of temperature on the bending strength of Swedish Pine wood.]** *Svenska SkogsvFören. Tidskr.* 38, 1940 (1–36). [Sw. sw.e.]

The investigation showed that (i) bending strength decreases with increasing temperature and decreasing specific gravity; (ii) with increasing moisture content, bending strength decreases at temperatures above 0° C. and increases at temperatures below 0° C.; (iii) the modulus of elasticity increases with decreasing temperature and moisture content and with increasing specific gravity; (iv) maximum deformation at the point of failure occurs at 0° C.; (v) the work done in deformation to the point of failure is greatest at 0° C. The effect of such factors on the storm felling of trees and on snow and ice breakage is discussed. *From author's summary.*

31.27 : 33.15 : 12.2. KOLLMANN, F., and SCHULZ, F. Versuche über die Drehfestigkeit von Flugzeug-Sperrholz. **[Experiments on the torsion strength of plywood used for aircraft.]** *Holz* 3, 1940 (52). [G.] [Mechanisch-Technologisches Institut der Reichsanstalt für Holzforschung.]

31.27 : 33.8 : 12.2. SAHLBERG, W. Träger aus Bongossiholz. **[Beams of Bongossi wood (*Lophira procera* A. Chev.).]** *Holz* 3, 1940 (15–9). [G.]

Details are given for the construction of I-beams consisting of a Bongossi wood centre-piece and of Beech or Horn-beam plywood cross-pieces. Also a description of some tests on the drying, gluing, and strength properties of Bongossi timber, which were carried out in connexion with the construction of the beams.

31.27 : 33.52 : 07.7. TURNBULL, J. M., and KROGH, P. M. D. **An improvised pole testing machine.** *J. S. Afr. For. Ass.* 3, 1939 (103–7). [Forest Products Institute, Pretoria West.]

'The appliance comprises (*a*) a concrete straining block to which butts of poles under test are strapped in a horizontal position, (*b*) a composite steel cable for attachment to the pole tips to cause deflection in a horizontal plane, (*c*) a suspended hand winch to take the strain causing the deflection and (*d*) a machine for registering the applied stress at deflections of fixed interval, up to failure'. The various parts are described in detail with illustrations. From a test on 49 *Pinus patula* telephone poles

figures are given for diameters and breaking strains, and for the comparison of theoretical and empirical breaking strains.

31.28. Working Qualities

31.28 (94). KINGSTON, R. S. T. **A reconnaissance of the bending qualities of some Australian timbers.** *J. Coun. sci. industr. Res. Aust.* 12, 1939 (264–74). Division of Forest Products Reprint No. 60. [Division of Forest Products, Melbourne, Australia.]

The technique adopted and the grading system used in assessing the quality of the completed bends are described. The results are discussed and shown in tabular form. So far, only 6 species have been tested at 4-in. radius, whereas 31 have been tested at 6-in. radius, the material being always 1 in. thick. The most important factors influencing the results of bending appeared to be moisture content, end pressure, steaming temperature and, above all, careful selection of material.

31.28 : 12.2. KINGSTON, R. S. T. **A study of the bending qualities of Karri (*Eucalyptus diversicolor*).** *J. Coun. sci. industr. Res. Aust.* 12, 1939 (359–65). [Division of Forest Products, C.S.I.R. Australia.] P.R.

One of the most important factors affecting the bending qualities of Karri was found to be moisture content. The most suitable moisture content appears to be between 25 and 40 per cent., air-dry material being distinctly inferior in bending quality to material at a higher moisture content. At least for bends with radius-thickness ratios of 6 or more, 600–800 lb. per sq. in. appears to be a suitable range of end pressure (180° bends). A minimum steaming period of 1 hour per inch of thickness was found adequate, while 1 hour in the straps after bending proved sufficient. Back-sawn and quarter-sawn material were found to bend equally well if free from checks, but checks caused more waste in selection with back-sawn than with quarter-sawn stock. *From author's summary.*

31.3. *Chemical Properties*

31.3. COHEN, W. E., and MACKNEY, A. W. **The preparation of a wood sample for chemical analysis.** *J. Coun. sci. industr. Res. Aust.* 12, 1939 (365–77). [Division of Forest Products, C.S.I.R., Australia.] P.R.

31.3 : 12.2. BROOKBANK, E. B., and BRAUNS, F. E. **The chemical nature of Douglas Fir lignin.** *Paper Tr. J.* 110 (5), 1940 (33–5). [Mead Corporation, Chillicothe, Ohio, and Institute of Paper Chemistry, Appleton, Wisconsin.] P.R.

31.3 : 12.2. O'DWYER, M. H. **The hemicelluloses of the wood of English Oak. V. The structure of hemicellulose B.** *Biochem. J.* 34, 1940 (149–52). [Forest Products Research Laboratory, Princes Risborough.]

31.3 : 33.32. BAILEY, A. J. **The chemistry of lignin. I. The existence of a chemical bond between lignin and cellulose.** *Paper Tr. J.* 110 (1), 1940 (29–34). [Department of Chemistry and Chemical Engineering, University of Washington, Seattle.] P.R.

31.3 : 33.32. BAILEY, A. J. **The chemistry of lignin. II. The butanolysis of wood.** *Paper Tr. J.* 110 (2), 1940 (29–32). [Department of Chemistry and Chemical Engineering, University of Washington, Seattle.] P.R.

31.3 : 33.32. YORSTON, F. H. **Advances in the chemistry of wood, 1938-39.** *Pulp Paper Mag. Can.* 41 (2), 1940 (144–8).

A brief review, with a bibliography of 54 references.

31.4. *Durability. Decomposition*

31.42. Attack by Plant Organisms

31.42 : 12.1 : 12.2. ZYCHA, H. Einfluss von Nährsalzen auf den Holzabbau durch Pilze. [**The influence of nutrient salts on the decomposition of wood by fungi.**] *Holz* 3, 1940 (50–1). [G.] [Forstbotanisches Institut der Universität Göttingen.]

Laboratory experiments showed that even in the case of relatively dry timber, considerable decomposition occurred in the presence of nitrogenous salts in certain concentrations. In choosing a filler for ceilings, one should therefore prefer materials poor in salts and nitrogen, e.g. slag, sand, &c. Clay is suitable only if obtained from a sufficient depth and not from fields. These precautions also apply when preservative-coated timber is employed.

31.42 : 12.11 : 12.2. BIRKINSHAW, J. H., and FINDLAY, W. P. K. **Biochemistry of the wood-rotting fungi. I. Metabolic products of *Lentinus lepideus* Fr.** *Biochem. J.* 34, 1940 (82–8).

31.42 : 12.2. YATSENKO-KHMELEVSKY, A. A., and BREGADZE, N. N. La résistance comparée de l'aubier et du bois parfait de l'épicéa et du sapin à l'action du champignon des charpentes (*Poria vaillantii* Fr.). **[The comparative resistance of the sapwood and the uncoloured heartwood of Spruce and Fir to the action of *Poria vaillantii*.]** *C.R. Acad. Sci. U.R.S.S.* 24, 1939 (626–8). [F.] O.R.S.

Laboratory tests were made on the comparative resistance of the uncoloured heartwood ('bois parfait') and sapwood of *Abies nordmanniana* and *Picea orientalis*, as judged by the loss in weight of a series of samples exposed for 4½ months to *Poria vaillantii*. No constant difference in resistance could be established between heartwood and sapwood of *A. nordmanniana*. In *P. orientalis* the heartwood tended to be more resistant than the sapwood, though the difference was scarcely significant statistically. Disregarding samples not completely covered with mycelium, the wood of *P. orientalis* taken as a whole was about twice as resistant as that of *A. nordmanniana*.

31.42 : 12.2. FINDLAY, W. P. K. **Douglas Fir and Baltic Redwood. The conclusions drawn from tests on their resistance to decay.** *Timb. Tr. J.* 152, 1940 (323–4). [Forest Products Research Laboratory, Princes Risborough, Bucks.]

Controlled tests of small pieces (10 × 2·5 × 1·25 cm.) of the heartwood of Douglas Fir (*Pseudotsuga taxifolia*) and Baltic Redwood (*Pinus sylvestris*), each species being represented by samples from six different geographical sources, and pieces of each sample being submitted to attack by *Merulius lacrymans*, *Coniophora cerebella*, *Poria vaillantii*, *Lentinus lepideus*, and *P. xantha*.

Very little difference in resistance to decay was shown by either species between samples from different regions or countries. Both species were about equally resistant to attack by the dry-rot fungus (*M. lacrymans*), while Douglas Fir was considerably more resistant to the other fungi used in the test, particularly *L. lepideus*. Widespread dote, which has been found in a number of consignments of Douglas Fir, is attributed to faulty treatment of the timber rather than to inherent liability to rot.

31.42 : 12.2 (52). IMAZEKI, R. **Observations on Japanese fungi. II.** *Jap. J. Bot.* 15, 1939 (440–9). [Jap.e.] R.A.M. 19 (119).

Descriptive notes on *Polyporus squalens*, *P. guttulatus*, *P. montanus*, *Trametes subrosea*, *T. malicola*, and *T. flavescens*, found on dead tree trunks in Japan.

31.42 : 12.2 (54 : 59.1). PADWICK, G. W. **India and Burma: new plant diseases recorded in 1938.** *Int. Bull. Pl. Prot.* 13 (11), 1939 (256–8). R.A.M. 19 (134).

Fomes melanoporus is recorded as causing laminated heartwood rot, and *F. lamaensis* as causing honeycombed heartwood and sapwood rot in *Shorea robusta*.

31.42 : 33.36. SPAULDING, P., and SCHEFFER, T. C. **Minimizing losses by sap stain and decay in wind-thrown timber.** U.S.D.A. Bureau of Plant Industry, Washington, D.C. [In co-operation with the Northeastern Forest Exp. Sta. & the Forest Products Laboratory.] 1939. pp. 5.

Barking to prevent beetle attack and spraying the barked logs with a 5 per cent. aqueous solution of Dowicide G, Dowicide H, Santobrite, or a 2 per cent. aqueous solution of Lignasan, is recommended as a control measure for sap stain. If barking is not possible, logs should be water-stored or converted as soon as possible; end treatment with the above chemicals will delay but not prevent attack. Converted timber is best protected by rapid seasoning and dipping in weaker solutions of the chemicals.

31.43. Attack by Animal Organisms

31.43 : 13.2. FISHER, R. C., and TASKER, H. S. **The detection of wood-boring insects by means of X-rays.** *Ann. appl. Biol.* 27, 1940 (92–100). [Forest Products Laboratory, Princes Risborough, & Messrs. Ilford, Ltd.]

The method shows promise of practical application for timber of small dimensions.

31.43 : 13.2 (47.4). BRAMMANIS, L. Über das Vorkommen des Hausbockes (*Hylotrupes bajulus*) in Lettland. **[On the occurrence of *H. bajulus* in Latvia.]** *Anz. Schädlingsk.* 16, 1940 (8–10). [G.]

This species occurs mainly in the province of Kurzeme, which has a mild maritime climate favourable to the insect and at the same time producing a poorly resistant Pine timber of rather low quality with broad annual rings.

31.43 : 32.8 : 13.2. TRÄGÅRDH, I. Tallbockens angrepp på vattenlagt virke. [**Attack by *Monochamus sutor* on water-stored timber.**] *Skogen* 27, 1940 (113–6). [Sw.]

Attacks by *Monochamus sutor* on water-stored bundles of logs at sawmills on the coast of Norrbotten were made possible by logs being floated in an unbarked condition. Examination showed that beetles from woods on the shore must have reached the bundles and oviposited in the logs lying above water level. In the full sunlight of such places the larvae completed their development much faster than in the woods. If, as was here the case, large quantities of logs lie over winter in water storage, they may also constitute foci of infestation for timber arriving the following year. Barking in the woods is ruled out as a control measure because (i) it is far more expensive than at the mills, and (ii) it introduces the risk of checking and sap-staining. A more practical measure should be the destruction of possible breeding places by clearing slash and dead wood from adjacent woods on the coast. In time, coniferous woods in the neighbourhood of water storage areas might be replaced with hardwoods. A further possible measure would be the sluicing of logs with water; this should have the additional advantage of discouraging sap stain.

31.43 : 32.8 : 11.15 : 12.2 : 13.2. MARTIN, C. H. **Effect of sun-light and of location of logs on the beetle infestations of Elm logs.** *Bull. Brooklyn ent. Soc.* 33, 1938 (195–201). [Cornell University.] I.I.E.

It appears that both *Hylurgopinus rufipes* (Eich.) and *Scolytus multistriatus* Marsham infest logs near the ground as readily as those high above it, that infestation by *H. rufipes* depends more on proximity of a log to the hibernating quarters of this species than to increased sunlight, and that increased sunlight falling on the logs will bring about a marked increase in *S. multistriatus* infestation.

31.43 : 33.36 : 13.2 (74.6). TURNER, N., and TOWNSEND, J. F. **Control of termites in buildings.** *Circ. Conn. agric. Exp. Sta.* No. 134, 1939. pp. 14.

A descriptive pamphlet on structural and chemical control measures against *Reticulitermes flavipes* Kollar, the only termite known to occur in Connecticut.

31.45. Injury by Fire

31.45. BRYAN, J., and DOMAN, L. S. **Fire resistance. The comparative resistance to fire of various species of timber.** *Wood* 5, 1940 (19–23). [Forest Products Research Laboratory, Princes Risborough, Bucks.]

The woods of some 85 tree species from different parts of the world were tested for (*a*) spread of ignitability, (*b*) rate of flame penetration, and (*c*) rate of burning as measured by time in seconds to lose 30–70 per cent. of its weight. These three aspects of fire resistance are not necessarily interrelated in any one species. The tests are described and illustrated and the species are classified according to the general property of fire resistance. In most cases the figures given are the results of not less than ten tests and the samples used were nearly all heartwood. The fire-resistant properties of a timber do not appear to be related to its fuel value.

31.7. *Specially valuable features and properties*

31.7 : 21.5 : 12.15 : 12.2. LARSEN, C. M. Masurbirk. [**Curly Birch.**] *Dansk Skovforen. Tidsskr.* 1940 (33–72). [Da.] [Skovtræforædlingen, Arboretet, Hørsholm, Denmark.]

In early spring, 1938, the author accompanied C. Syrach Larsen on a tour in Finland to study Curly Birch and to bring back grafting scions for propagation at the Hørsholm Arboretum in Denmark. A general account is given of the trees and of the characteristics and uses of the wood. The peculiar figure, not to be confused with other types of figure in Birch, is attributed to a disease whose nature is still the subject of conflicting theories; but whatever its nature, the peculiarity is heritable. The paper concludes with a description of the grafting methods used at Hørsholm and of the grafts made from the Finnish scions. The percentage of successful grafts was low, but will probably improve as fresh scions from the first grafts become available. Some of the grafts have already begun to develop curled figure. Breeding experiments are also being carried out on the lines described by Ording [*For. Abs.* 1 (136)], and attempts are being made to achieve successful propagation by cuttings.

31.8. *Defects of Timber*

31.8 : 12.12 (77.7). GENAUX, C. M., and KUENZEL, J. G. **Defects which reduce**

quality and yield of Oak-Hickory stands in south-eastern Iowa. *Res. Bull. Ia. agric. Exp. Sta.* No. 269, 1939 (408–44).

Slightly over 60 per cent. of 753 sample trees representative of that region were partially defective from one or more causes. Volume loss from all types of defects averaged 8·5 per cent. of the total volume of trees in the merchantable size class, 5·2 per cent. of the total volume of large poles, and 6·3 per cent. of the total volume of saplings. Volume loss due to decay following fire scars averaged 7 per cent. of the total volume of trees in the merchantable size class and 0·1 to 2 per cent. in the smaller size classes. In White Oak, the most important species represented, the percentage of defective volume decreased with increasing diameter. Sixty per cent. of all trees bore insect injuries, although the defects caused by insects averaged less than 2 per cent. of the total volume for all diameter classes. In three out of four defective trees the defects were evident only after felling and splitting.

31.8 : 31.1–2 : 12.15. JACOBS, M. R. **Further studies on fibre tension.** *Bull. For. Bur. Aust.* No. 24, 1939. pp. 36.

This paper describes experiments on the length measurement of the tension of the sapwood of *Eucalyptus gigantea* and the consequent compression of the heart. Results obtained by length measurements are compared with deductions as to the compression of the heart made from the deflection of sapwood strips, and found to agree. This leads to a simple method of arriving at the compression of the heart at different diameters. The forces causing a leaning tree to straighten are measured on a spring balance. Various aspects of the phenomenon of fibre tension are discussed. *Author's summary.*

31.8 : 31.27. ALEXANDER, J. B. **Cross-grain in lumber, and its effect upon strength.** Forest Products Laboratories of Canada, Vancouver Laboratory. 1939. pp. 4. P.R.

32. HARVESTING OF WOOD. LOGGING

32.1. *Marking of Trees and Coupes*

32.1 : 07.7. KNUCHEL, H. Der Reisser. **[The timber scribe.]** *Schweiz. Z. Forstw.* 91, 1940 (127–30). [G.]

Various types of timber scribe are described and illustrated.

32.2. *Felling. Extraction*

32.2 : 07.7. **Time-saving tool for woodsmen.** *Woodlands Rev.* 11 (3), 1940 (4).

The No. 128 Saw Punch, marketed by Sandvik Canadian Ltd., Montreal, for making new pin holes in saw blades and for cutting down the gullets between worn saw teeth.

32.2 : 07.7. MCNALLY, J. A. **Skidding with tractor and sulky.** *Woodlands Rev.* 11 (2), 1940 (10, 12). [Anglo-Canadian Pulp & Paper Mills, Ltd.]

The description of experimental logging work which involved the hauling of bundles of tree-length pulpwood logs. The sulky is a light and inexpensive unit better suited to this type of work than the standard arch equipment. It is equipped with 10-ply tyres having two extra ply beneath the tread, and a 12-ft. or somewhat shorter drawbar. The average load carried was 2·1 cords of wood in tree lengths. The RD-6 caterpillar was found to be the most efficient motive power unit for use with the sulky.

32.2 : 07.7. MCNEIL, D. J. **Tractor logging carts.** Woodlands Section, Canadian Pulp & Paper Association, Montreal. [*Woodlands Section Index* No. 484 (B-8-f).] 1939. pp. 2.

With special reference to a unit used with 'caterpillar' tractors D-4 and D-2, which has the following points: (1) pneumatic-tired wheels 5 ft. in diameter, (2) fairlead assembly for using winch line, (3) log clearance under arch and between wheels, (4) light weight, and (5) low cost.

32.2 : 07.7. Släpkörning med gummihjulskärror. **[Timber hauling with rubber-tired trolleys.]** *Skogen* 27, 1940 (97–8). [Sw.]

A horse-drawn, two-wheeled skidding trolley, known under the trade name of 'Lenna-Kärran', is described. It has metal wheels that take standard rubber tires 16 in. in diameter and 4 in. thick. The top bunk is pivoted for ease of steering. A novel feature is that the bases of the shafts are shaped as runners, so as to skid easily over boggy ground. An account is also given of a two-wheeled trolley for hauling wood in lengths of 12 ft. or less; the chief feature of this is that ease of steering is achieved by placing the wheels near the centre of gravity of the load.

32.2 : 37 : 07.7. DONNELLY, N. C. **'Watering' pulpwood with tractor power.** *Woodlands Rev.* 11 (5), 1940 (10–11).

A Canadian pulpwood contractor has developed a method whereby a 4-man crew with a tractor was able to unload stacked pulpwood into the river at the rate of 500 cords per day. It is estimated that 50 men would have been needed to perform the same operation by hand. The 4-man crew consisted of one man on the log pile, two in the water to break up jams, and one, the tractor-driver, to push the logs into the stream. The tractor was equipped with a bullgrader to which a home-made extension was fitted to increase its capacity and protect the machine. It is considered that still higher efficiency could be attained by the use of factory-made equipment.

32.2 : 37 : 07.7. REYNOLDS, R. R. **Truck logging with detachable trailers.** *Occ. Pap. Sth. For. Exp. Sta.* No. 85, 1939, pp. 6. [Southern Forest Exp. Sta.]

A system has recently been evolved in Arkansas for supporting detached trailers while being loaded and for rapid coupling and uncoupling of loaded and empty trailers from trucks. This consists of an effective truck-hitch and a 'horse' or standard which supports the detached trailer. From preliminary studies the new system appears to be of economical value.

32.2 : 37 : 38 (43.1–5). EBNER, A. **Role of mechanized logging in German forest management.** Woodlands Section, Canadian Pulp & Paper Association, Montreal. [*Woodlands Section Index* No. 500 (B-1).] 1939. pp. 29.

The subject is discussed under the headings: historical survey, skidding, forest road construction, forest products commonly hauled by motor trucks, recent use of trucks for hauling forest products, and economic factors affecting the use of motor trucks. Useful statistics are tabulated for each part and 82 photographs illustrate the text.

32.2 : 37 (71). KOROLEFF, A. **Mechanization of our logging operations.** *Woodlands Rev.* 11 (2), 1940 (7–9). [Canadian Pulp & Paper Association.]

Greater mechanization is advocated. A table is appended containing notes on power used now, and on mechanization possibilities in various phases of pulpwood logging operations in eastern Canada.

32.3. *Sorting according to Final Products*

32.3 : 35. ANDERSON, I. V. **Grading of logs and trees as a means of measuring quality.** Northern Rocky Mt. Forest & Range Experiment Station, Missoula, Montana. 1939. pp. 23.

Includes specifications, suggested by author, for log and tree grades of Ponderosa and Western White Pine.

32.3 : 35 (492). Verslag van de Standaardeeringscommissie 1938 der Nederlandsche Boschbouwvereeniging. **[Report of the 1938 Standardization Committee of the Dutch Forestry Association.]** *Ned. Boschb.-Tijdschr.* 13, 1940 (113–63). [Du.f.e.g.]

A detailed report on the sorting and grading of timber in Holland. Forest owners have hitherto given little attention to this matter, and there has been insufficient general agreement on the names and dimensions of the various assortments. Among the recommendations designed to remedy this situation is the proposition that, in standardizing current grades, adjustments should be made to favour the use of home-grown timber. Many minor concessions could be made in technical grade requirements without loss of practical efficiency and with greater economy of material in conversion.

32.4. *Inventory and Evaluation of Felled Timber*

32.4 : 33.32 (71). RUTHMAN, H. D. **Reduction of wood inventories.** *Pulp Paper Mag. Can.* 41 (2), 1940 (191–3). [Anglo-Canadian Pulp & Paper Mills Limited.]

The chief if not the only possibility of reducing pulpwood inventories lies in changing logging methods to shorten the period between cutting and delivery. If snow and water transport are to be decreased to any extent, this aim can only be achieved by a greater degree of mechanization.

32.5. *Logging Costs*

32.5. AB-YBERG, W. **Introduction of production standards into the preparation of logging cost. Their application and use in logging supervision.** Woodlands Section, Canadian Pulp & Paper Association, Montreal. [*Woodlands Section Index* No. 479 (B-1).] 1939. pp. 9.

The Canadian International Paper Co. has undertaken a careful examination of logging costs since 1931 as a basis for determining production standards. Data on operation costs and on production possibilities for different densities of stand and sizes of tree are tabulated. The relation between operating costs and variables of operation such as local conditions, size of contract, distances, &c., are shown graphically.

32.5 : 32.2 : 07.7 (75.9 : 76.1–2 : 76.5). WORTHINGTON, R. E. **Costs of tractor logging in Southern Pine.** *Tech. Bull. U.S. Dep. Agric.* No. 700, 1939. pp. 63. [Central States Forest Exp. Sta.]

Most of this study was carried out at Crossett, Arkansas, in the spring of 1936 under unusually dry weather conditions. Skidding costs were obtained for different tree sizes and lengths of haul for a number of sizes of tractors and methods of skidding, and log-loading costs were computed by tree size for both car and truck loading, the data being compared with skidding and loading costs mainly from the Ponderosa Pine region. Logging damage to the remaining stand was also examined. An outstanding feature of the operating cost of tractor equipment was the fact that about one-half of the total cost consisted of fuel, maintenance, repair, and transportation of the crew, one-fourth of operating labour cost, and the remaining fourth of ownership costs, such as depreciation, interest, taxes, &c. Individual performances in tractor skidding varied considerably, both in output and cost, with type of equipment, operating conditions, and the efficiency of the crew. For distances exceeding 1,000 ft. ground-skidding tractors appeared to be more costly than pan- or arch-skidding tractors. The lowest costs of all the cases where the skidding distance exceeded 1,000 ft. were obtained under a relay system where a team and teamster concentrated the load prior to skidding to the landing with tractor and pan. The performance of the tractors recorded in this investigation was more efficient than that of tractors in other parts of the country for which data are available. Skidding damage in the remaining stand was much smaller than felling damage.

32.8. *Storage of Wood in the Rough*

32.8. HALLANDER, Å. Täckning av ved. En ny vedpapp utexperimenterad. **[The covering of cordwood. A new kraft paper tested.]** *Skogsägaren* 16, 1940 (34–8). [Sw.]

'Munksjö VE-papp' is a promising new material for covering stacked firewood. It is an extra-strong kraft paper, impregnated and subsequently coated on one side with oil-asphalt. The asphalted surface is dusted with talc to prevent sticking. At present, the paper is produced in rolls 1·2 m. wide, but it is possible that rolls 10 cm. narrower might prove more economical.

33. CONVERSION AND PRESERVATION OF WOOD

33 : 32 (74). BENSON, A. O. **Woods and mill studies of the manufacture of Birch, Beech, and Maple lumber in the Northeast.** Forest Products Laboratory, Madison, Wisconsin. 1939. pp. 35. P.R.

33.15. Manufacture of Veneers and Laminated Wood. Gluing

33.15. HORWITZ, S. **Modern adhesives. Synthetic glues in the veneer and plywood industry.** *Wood* 5, 1940 (4–7).

33.15. ROSSER, G. L. **Animal glues and their use in woodworking.** *Bull. Dom. For. Serv.* No. 96, 1939. pp. 39.

33.15. TENGER, C. G. **Plywood.** *Canadian Patent* 383,366, Aug. 15, 1939. Chem. Abs. 33 (9584). P.R.

The plies of veneer bonded by a water-repellant adhesive are stabilized against dimensional changes due to moisture by impregnating with a sugar solution containing a colouring before the wood is cut into plies, e.g. sugar 5–35, H_3BO_3 0·25–3, wetting agent 0·1–0·5, dye 0·5–2, and cellosolve 0·5–2 per cent.

33.15 : 31.27. OPITZ, H., and REESE, H. Über die Eignung des Schichtholzes für die Herstellung von Zahnrädern. **[On the suitability of [compressed] laminated wood for the manufacture of cog-wheels].** *Holz* 3, 1940 (19–22). [G.g.]

Experiments at Aachen with Beech veneers cemented with artificial resin under high and under low pressure, showed that high pressure was essential for material to serve in the manufacture of cog-wheels for work under considerable strain. High pressure produced material of considerable bending

strength and resistance to impact (Schlagbiegefestigkeit), while laminated wood cemented under low pressure was not only weaker, but also less resistant to moisture penetration. The wear and tear of cog-wheels from low-compression laminated wood increased less with increasing peripheral speed than the wearing of (non-laminated) hardwood wheels did. On the other hand, the latter suffered less than the former from work under high strain.

33.16. Wood Wool Manufacture

33.16 : 33.32 : 12.2. KOLLMANN, F. Untersuchungen über die Herstellung von Holzwolle, insbesondere Buchenholzwolle, zu Leichtbauplatten. **[Investigations on the manufacture of wood wool, particularly Beech wood wool, for light fibre boards.]** *Holz* 3, 1940 (33–43). [G.g.] [Mechanisch-Technologisches Institut der Reichsanstalt für Holzforschung.]

A series of tests on the efficiency of wood-wool machines is described. In the utilization of Beech wood 8 machines are required to work the same amount of raw material (solid cu.m./h.) as 5 machines do in the case of Spruce. Beech wood wool is odourless; its weight, though 55 per cent. higher than that of Spruce wool, is not excessive, and it is durable. A 50 per cent. admixture of Beech wool to Spruce wool is being adopted with advantage in the manufacture of fibre boards bound with gypsum or magnesite, but there are still certain difficulties to overcome when cement is used as the binding material.

33.3. *Chemical Treatment*

33.32. Pulp and Paper Manufacture

33.32. BRECHT, W., and KILPPER, W. Das Weiss- und das Braunschliffverfahren in ihrer Abhängigkeit von der Schleiftemperatur. **[The 'white' and 'brown' pulping processes in relation to the grinding temperature.]** *Papierfabrikant* 38, 1940 (22–4). [G.g.] P.R.

In the pulping of steamed wood (Braunschliffverfahren) the amount by weight of Spruce and of Pine pulp produced, per unit of energy output, increased considerably with increasing temperature, as did the drying ability of the pulp, its volume, absorptive capacity, and air permeability. The higher temperature reduced the strength properties of the pulp. In the case of unsteamed wood, the process (Weissschliffverfahren) appeared to be far less influenced by temperature conditions.

33.32 (51). L'industrie de la pulpe de bois et de la rayonne en Mandchourie. **[The wood-pulp and rayon industry in Manchuria.]** *Rev. int. Bois* 7 (73–74), 1940 (18–20). [F.]

Under the Japanese régime the wood-pulp industry of Manchuria has been developed primarily to supply the Japanese artificial-silk industry, and at present over 40,000 metric tons of rough pulp are shipped annually. Now efforts are being made to increase this production to meet the war-time demands of the Japanese textile and paper industries and to contribute as far as possible to Japanese independence of foreign supplies.

33.32 (68). LOSEBY, P. J. A. **Pulp and paper making as a South African industry.** *J. S. Afr. For. Ass.* 2, 1939 (56–69). [Forest Products Institute, Pretoria.]

A general description is given of the more important processes of pulp manufacture and the essential characteristics of suitable raw materials, together with a discussion of recent developments in the industry and figures on paper consumption in South Africa.

33.32 (82). WORSCHITZ, F. Posibilidades de industrias papeleras y anexos en la Argentina. **[Possibilities of the papermaking and allied industries in Argentina.]** *Maderil* 12 (141), 1940 (12–6, 25–8). [Span.]

33.32 : 33.0 (71). RUNNING, K. D. **Pulp and paper mill utilization of hardwoods and other 'little used' species.** *Pulp Paper Mag. Can.* 41 (2), 1940 (181–4, 190). [Anglo-Canadian Pulp & Paper Mills Limited.]

The main species considered are:—Birch, Maple, Aspen, Jack Pine, White Pine, Beech, and Tamarack. Estimates are given of the available quantities of the various woods. Data have been secured on the economics of logging and of special logging procedures. The relative costs per cord and per ton of softwood and hardwood are given. Difficulties and benefits of pulping the species for groundwood, sulphite and soda pulps are considered. Special properties of pulps, which indicate special uses, are also noted, and recommendations for future study are given. *From author's summary.*

33.32 : 12.2. JAYME, G., and KERLER, E. Über die Eigenschaften faseriger Holozellulosen aus Buchenholz. **[On the properties of**

fibrous holocelluloses from Beech wood.] *Holz* 3, 1940 (2–7). [G.g.] [Holzforschungsstelle im Institut für Zellulosechemie der Technischen Hochschule Darmstadt.]

The strength properties are quite adequate for paper manufacture. It is shown that a higher yield of holocelluloses from Beech wood is possible than that obtained in practice in the past.

33.32 : 33.0 : 12.2. CARPENTER, C., and RITTER, G. A. **The use of Swamp Black Gum sulphate pulps for high grade papers.** *Paper Tr. J.* 110 (3), 1940 (29–31). [Southland Paper Mills, Lufkin, Texas, and Herty Foundation Laboratory, Savannah, Georgia.] P.R.

Bond papers of high strength characteristics were made from bleached sulphate pulp of *Nyssa biflora*. The experimental conditions are described.

33.32 : 12.2. BRAY, M. W., MARTIN, J. S., and SCHWARTZ, S. L. **Sulphate pulping of Southern Yellow Pines. II. Effect of growth variables on yield and pulp quality.** *Sth. Pulp Paper J.* Nov. 1939. pp. 7. Repr. [Forest Products Laboratory, Madison, Wisconsin.] P.R.

Sulphate cooking experiments on top, middle, and butt logs of Shortleaf Pine (*Pinus echinata*) and Loblolly Pine (*P. taeda*) confirm the previous findings that (*a*) butt logs give the highest percentage of screened pulp; (*b*) apart from some anomalous cases, bursting and tensile strength of the pulp tend to increase and tearing strength to decrease with increasing height of the log in the tree, i.e. with an increase in the springwood-summerwood ratio; (*c*) greater differences exist between the strength properties of pulps from different parts of the same tree than between those of pulps from different species of Southern Yellow Pine of similar growth rate and physical properties. It was also found that decayed wood, compression wood, and possibly spiral-grained and very rapidly grown wood, appear to give pulps with abnormal strength values. When not affected by decay, top bolts cut above the merchantable length of dominant saw-log trees gave pulps of medium strength values.

33.32 : 33.35 : 33.0 : 12.2. PARKINSON, L. **Seasoning as a control of pitch in Poplar sulphite pulp.** *Paper Mill* 62 (5), 1939 (16–18, 20). [Flambeau Paper Company.]

Pitch occurred in bleached sulphite pulp made from freshly cut Poplar, but a series of tests showed that entire freedom from pitch trouble could be secured by barking the pulpwood and seasoning it for ten weeks before use. Bleaching reduced but did not eliminate pitch in the wood pulp. The question is raised whether the pitch of Poplar is similar in constitution to that of Spruce and other conifers.

33.32 : 33.0 : 31.23. MCMICHAEL, C., and MCINNIS, R. J. **The economic possibilities of using high density wood.** *Pulp Paper Mag. Can.* 41 (2), 1940 (194–5). [Anglo-Canadian Pulp & Paper Mills Limited.]

Balsam Fir and Black Spruce, the chief pulpwood species of eastern Canada, have densities of 0·33–0·38 and 0·4–0·48 respectively. Although the cost of cutting, stacking, hauling, and floating is about the same for both species, a comparison of manufacturing costs shows that all-round savings may be effected by using high-density wood. Percentage figures are given for the savings that may be expected from the use of 0·4 density as compared with 0·33 density wood.

33.32 : 31.3. SCHWABE, K. Holzgummibestimmung ohne Jodkalium. **[Determination of wood gum without potassium iodide.]** *Papierfabrikant* 38, 1940 (6–7). [G.] P.R.

33.35. Seasoning. Drying

33.35–6. I.G. FARBENIND. A.G. [Hans Klein, Hans Scheuermann and Walter Ziese, inventor.] **Hardening wood.** *German Patent* 679,791, 15th Aug. 1939. Chem. Abs. 33 (9584). P.R.

Wood is seasoned by treatment with liquid NH_3 or methylamine at 100° under pressure.

33.35. PERRET, G. Le séchage des bois. **[The seasoning of timbers.]** *Rev. int. Bois* 7, 1940 (42–51). [F.]

Mainly a proof, by means of examples from the French practice, that air seasoning is economically inferior to kiln drying, especially when the latter is automatically regulated by means of the 'Vibo' process.

33.35. **The air-seasoning of timber.** *Tr. Circ. Coun. sci. industr. Res. Aust.* No. 46, 1939. pp. 19.

33.35. KAHN, S. H. **Chemical drying of timbers.** *Wood* 5, 1940 (44–5).

Ordinary salt is the most satisfactory chemical for most purposes, although inverse sugar must be used where the dried wood requires high electrical insulating power. High temperatures above 160° F. should be avoided and speed of drying should not be too great. Swamp Oak timbers 4 in. × 4 in. are satisfactorily seasoned after 4 days' soaking and 12 days' drying. A schedule for very large timbers requires 3 days' soaking, varying the salt solution from 30 per cent. to concentration, 19 days' drying at 160° F. and 70 per cent. relative humidity after which the humidity is dropped to 45 per cent. The surface of salt-seasoned timbers tends to remain moist until painted or varnished.

33.35. HERMANN, A., and RASMUSSEN, C. A. **Factors affecting rate of airflow in Pine kilns.** *W. Cst. Lumberm.* 67 (3), 1940 (66–70). [Western Pine Association, Portland, Oregon.]

33.35 : 07.7. EGNER, K. Neuere Untersuchungen zur natürlichen Holztrocknung (Schaukeltrocknung). [**Investigations on the natural seasoning of wood ('swing-rack' seasoning).**] *Holz* 3, 1940 (7–15). [G.g.]

The 'swing-rack' is a new patented device which holds the material to be seasoned and is swung by means of a motor. According to recent investigations by the Institut für Materialprüfungen des Bauwesens der Technischen Hochschule Stuttgart, this machine accelerates drying considerably until the fibre saturation point is reached, but it is still very doubtful whether the advantage thus gained warrants the extra expenditure involved.

33.35 : 31.1. KAPUR, S. N., and REHMANN, M. A. **Notes on the air seasoning characteristics of some Indian woods.** [Supplement to the 'Manual on the Air Seasoning of Indian Timbers']. *Indian For. Rec.* (*n.s.*) *Utilization* 1, 1939 (211–31). [Forest Research Institute, Dehra Dun, India.]

The girdling of standing trees as a preliminary operation in moisture reduction and seasoning has been found to be ineffective for such species as Deodar (*Cedrus deodara*), Mango (*Mangifera indica*), Toon (*Cedrela toona*) and Jaman (*Eugenia jambolana*). The soaking of sawn material in water before air seasoning has not proved to be of any value. For woods particularly difficult to season such as *Anogeissus latifolia*, *Schima wallichii*, *Quercus lineata* and *Q. lamellosa*, best results are obtained by seasoning in the form of thick planks with subsequent conversion to thinner size. Notes are given on the air-seasoning characteristics of the woods of 51 species.

33.35 : 31.22 : 35. FRYER, H. **Moisture content segregation at the green chain.** *W. Cst. Lumberm.* 67 (2), 1940 (46–7).

Using data from tests at mills in three Pine areas and at a Western Hemlock mill, the author argues that moisture content segregation of the timber previous to kiln drying would result in more satisfactory and less expensive drying and in less drying degrade.

33.36. Preservation of Wood. Impregnation

33.36. WYK, J. H. VAN, and LOSEBY, P. J. A. **The preservation of wood.** *J. S. Afr. For. Ass.* 2, 1939 (11–30). [Forest Products Institute, Pretoria.]

A general discussion of the subject under the headings:—The development of wood preservation in South Africa, the structure of wood, destructive agencies, wood preservatives, preparation of poles for preservative treatment, treating processes used in wood preservation, durability of untreated wood, durability of treated wood, and protection of interior wood work. Indigenous and exotic tree species are listed according to whether their woods are durable or non-durable.

33.36. MOORE, G. E. **Concentrations of water-soluble preservatives in treated timber.** Forest Products Laboratories, Ottawa. 1939. pp. 10.

Some data on zinc-chloride concentrations in ties after 4 to 9 years and in butt-treated fence posts after 4 years' service, and on copper sulphate concentrations in butt-treated fence posts after treatment.

33.36 (43.1–5). FOULON, A. Holzimprägnierung. [**Wood impregnation.**] *Z. Papier* (formerly *Zbl. PapIndustr.*) 57, 1939 (277–9). [G.] R.A.M. 19 (180).

The use of the Rueping process is estimated to result in a 25 per cent. saving in coal tar oil as compared with the full-pressure system. Of late years, coal tar has been largely replaced by Wolman salts, especially in mines, where the former substance is unsuitable by reason of its inflammability and detrimental effects on health. Since about 60 per cent. of the commercial coal tar oil constituents are needed for

motor transport, a method has been devised of combining the remainder (viscous fractions) with Wolman salts to ensure first-class protection of the wood. Excellent results are obtained by combining the arsenic, hydrofluoric, and fluosilicic acid colour bases—which are insufficiently penetrative by themselves—with non-aqueous solvents such as coal tar, phenols, and alcohols. Another effective preservative consists of an aqueous solution of the silicic acid esters of phenols, e.g. $Si(OC_6H_5)_4$. Other efficient solvents for wood preservatives include organic halogen compounds, which themselves exert a strong protective action. Trivalent arsenic compounds have been found more efficaceous than quinquevalent. Copper and zinc are resistant to lixiviation and lend themselves to combination with arsenic, while a further improvement is embodied in a new patent (DRP. 636,873) by R. Falck, involving the use of cold neutral aqueous arsenic trisulphide solutions in colloidal form.

33.36 (44). Taborovsky, E. Le bois—sa conservation. Les procédés d'imprégnation appliqués en France. **[The preservation of wood. Impregnation processes employed in France.]** International Advisory Office on Wood Preservation, 9 Oranjestraat, The Hague, Holland. 1938. pp. 22. [F.]

33.36 : 01. Pablo. Träimpregnering med arseniksalter. **[Impregnation of wood with arsenic salts.]** *Skogen* 27, 1940 (101–04). [Sw.]

A popular account of the process developed by the Boliden Mining Company, whereby wood is impregnated with a solution containing arsenic acid, sodium arsenate, sodium bichromate, and zinc sulphate in certain fixed proportions. Zinc arsenate and chromium arsenate are precipitated in the wood, both being insoluble in water yet toxic to fungi and insects; the remaining products of the reaction, sodium sulphate, water, and oxygen, are harmless. Pine is readily impregnated by this process, but Spruce is as yet difficult to treat. A description is given of a large impregnation plant at Forssjö, with details of methods of operation.

33.36 : 01. Ikert, B. Die Fluorbestimmung in der Holzkonservierungstechnik. II. Die Bestimmung des Fluors im Holz. **[The determination of fluorine in the technique of wood preservation. II. The determination of fluorine in the wood.]** *Chemikerztg.* 63, 1939 (754–5). [G.] P.R.

Description of a new method, claimed to be precise. The sample is split into small bits, soaked with a solution of chromous acetate and calcium acetate, and incinerated. The fluorine is distilled from the ashes in the form of fluosilicic acid, and the amount of calcium silicofluoride is determined from the distillate.

33.36 : 09.4 (73). Helphinstine, R. K. **Quantity of wood treated and preservatives used in the United States in 1938.** U.S.D.A. Forest Service, Washington, D.C. [In co-operation with the American Wood Preservers' Association.] 1939 (?). pp. 39.

33.36 : 12.2. Spoon, W., and Sesseler, W. M. Drijfvermogen van met paraffine geconserveerd balsa-hout. **[Buoyancy of Balsa wood treated with paraffin.]** *De Indische Mercuur* 62, 1939 (289 et seq.). [Du.e.]; *Berichten van de Afdeeling Handelsmuseum van de Kon. Vereeniging Koloniaal Instituut* No. 135. pp. 18. P.R.

Test pieces of Balsa wood (*Ochroma* spp.) grown in Java, were immersed for about 2 hours at 150° C. in paraffin with a melting point of 48–50° C. The treatment raised the specific gravity of the wood, which ranged from 0·15 to 0·30 in an air-dry condition, by an average of 0·02. The buoyancy of the treated wood as determined experimentally was slightly below the theoretical value; this was due to the fact that impregnation did not prevent a slight surface absorption of water, although after the small initial uptake of water, no further absorption occurred over a 24-hour period. According to this experiment Balsa wood can be successfully employed for life belts; in practice, however, its use is restricted to wood with a specific gravity of 0·12 or lower as wood of higher specific gravity would be cumbersome in spite of possessing sufficient buoyancy.

33.36 : 31.4 : 12.2. Cummins, J. E., and Turnbull, R. F. **The preservative treatment of fire-killed Mountain Ash (*E. regnans*) and Alpine Ash (*E. gigantea*).** *J. Coun. sci. industr. Res. Aust.* 12 (4), 1939. pp. 9. Division of Forest Products Reprint No. 63. [Division of Forest Products, C.S.I.R., Australia.]

Details are given of the causes of deterioration of fire-killed timber from a study of two areas containing Mountain Ash [*Eucalyptus regnans*]

killed in the 1926 and 1932 fires, and of the conditions favouring the development of degrade from physical causes, pin-hole borers, and decay. Recommendations are made for the preservative treatment of salvage-felled timber, stored under varying conditions. *Authors' summary.*

33.36 : 31.42 : 31.43 (215). EDWARDS, W. H. **The preservation of wooden buildings in the tropics, with special reference to conditions existing in Jamaica.** Department of Science & Agriculture, Kingston, Jamaica. 1939. pp. 42. P.R.

Preventive and control measures against termites and wood rots are described.

33.36 : 31.43 : 13.2. **Monsanto Permatol 'A' for *Lyctus* (powder-post) beetle control.** *Monsanto tech. Bull.* No. 0–14, 1939. pp. 5. P.R.

This preparation, consisting of pentachlorphenol dissolved in suitable solvent oils, has been shown in laboratory experiments to be toxic to both larvae and adults of *Lyctus* beetles. It is also suitable for application to sound, seasoned wood as an aid in preventing infestation. Spraying and brushing do not afford complete protection; the wood should therefore be treated by dipping in the preservative for a period varying with the size of the stock, the species of wood, and whether or not the stock is infested. In addition to its toxic effect when taken internally, the preparation is a skin irritant, and some care is needed in handling it.

33.36 : 31.45. SCHLYTER, R. Eldskyddspreparat för träkonstruktioner och textilier. **[Ignition-retarding agents for wood constructions and textiles.]** *Medd. Provn-Anst. Stockh.* No. 62, 1939. pp. 41. [Sw.e.] P.R.

The standard procedure in testing fireproofing agents is described and the results of experiments by the Swedish State Testing Institute (Statens Provningsanstalt) are quoted. The chemical composition of a number of fireproofing agents bought by the Institute in the open market is indicated together with notes on their relative effectiveness, but the trade names of the preparations are suppressed. A second list gives the names of 8 proprietary fire-proofing preparations approved by the Institute and indicates the type of treatment and quantity of fire-proofing agent required per unit area of wood.

33.36 : 33.31. CARSWELL, T. S., and HATFIELD, I. **Pentachlorophenol for wood preservation.** *Industr. Engng. Chem.* (*Industr. Ed.*) 31, 1939 (1431–5). [Monsanto Chemical Co., St. Louis, Mo.] P.R.

Pentachlorophenol is a particularly valuable wood preservative where a clean treatment is desired that has no detrimental effect upon the further finishing of the wood or the application of paint, putty, &c. It is colourless, has no objectionable smell, and its volatility and water solubility are low; it is highly toxic to fungi, micro-organisms, termites, and probably also to marine borers and powder post beetles. If reasonable precautions are taken, it is not dangerous to human health. Pentachlorophenol can be applied as the sodium salt in aqueous solution (e.g. Santobrite), or as the pure substance in various organic solvents. In general, it is applied as a 5 per cent. solution in petroleum oils. The solutions may be applied by pressure treatment, hot and cold dipping, immersion, or hand brushing or spraying. Pressure treatment at the rate of 0·5 pounds of preservative per cu. ft. of wood has proved exceptionally effective against decay and termite attack. Except where an excess of the chemical was used, the application of the substance in proper solvents has not affected the finishing of the treated wood.

33.36 : 33.51. TREVOR, J. S. **The preservation of pit timber.** *Colliery Engng.* 16 (183), 1939 (181–3). R.A.M. 19 (129–30).

At a colliery near Nottingham the average uptake of creosote in the open-tank method was 10·9 lb. per cu. ft. of props at a cost of 7·5*d.* per cu. ft. A five-year test of treated props showed 40 out of 47 still sound, while 48 out of 50 untreated controls were rejected. Thirty-three out of 35 props were adequately preserved over the same period by impregnating with 2 per cent. zinc chloride at a cost of 2·1*d.* per cu. ft. Treatment with Wolman salts at a strength of 2 per cent., costing 3·5*d.* per cu. ft., preserved 48 out of 49 props. A promising new preservative is copper naphthenate as a 15 per cent. white spirit solution: it is non-inflammable and clean, and, being quite insoluble in water, is suitable for all timber used in wet places. Prolonged immersion in water hydrolyses the compound to copper hydroxide and naphthenic acid, both toxic to wood-rotting fungi. Other potentially useful preservatives are discussed in brief.

33.36 : 33.51 : 09.4. **Report of 30th annual inspection of C., B. & Q.R.R. experimental ties.** *Wood Pres. News* 18 (1), 1940 (1–4). P.R.

The results of the 1939 inspection of experimental ties laid by the Chicago, Burlington and Quincy Railroad Company in 1909 and 1910 are tabulated by species and treatment. The treatments include (1) coal tar creosote by full-cell process with 10–12 lb. per cu. ft., (2) zinc chloride (Burnett process) with ½ lb. per cu. ft., (3) a mixture of these preservatives (Card process) with ½ lb. of zinc chloride and 3 lb. of creosote per cu. ft. The following table summarizes the results of 30 years' service.

Lines East

Process	*Total placed*	*Total removed to date*	*Per cent. removed account decay*	*Actual average years life to date*
Creosote	2,046	1,493	25	28·0
Card	10,241	9,568	34	19·1
Burnett	1,578	1,571	55	16·1
Untreated	2,046	2,046	90	5·4
	Lines West			
Creosote	1,236	838	17	28·5
Card	5,591	5,195	34	17·9
Burnett	910	907	49	15·0
Untreated	1,226	1,226	91	5·8

The average life of untreated ties in years is summarized by species as follows:

Cottonwood	2·9	Tamarack	5·1
Sycamore	3·3	Loblolly Pine	5·3
Tupelo Gum	3·5	Poplar	5·3
Red Birch	3·6	Red Oak	5·3
Soft Maple	3·6	White Elm	5·3
Red Gum	4·1	Hickory	5·5
Hard Maple	4·7	Pin Oak	6·3
Hemlock	4·9	Cypress	8·3
Beech	5·0	Chestnut	9·7
Ash	5·1	White Oak	11·1

33.36 : 33.51 (73). Report of Committee 17—wood preservation. Appendix D (4). **Effect of preservative treatment by the use of creosote-petroleum, and zinc chloride and petroleum.** *Proc. Amer. Rly. Engng. Ass.* 40, 1939 (493–505). R.A.M. 19 (316).

Performance tables are given for about 1,000,000 hardwood and conifer sleepers in various American railway lines, treated with creosote-petroleum mixture, zinc chloride-petroleum, or zinc chloride, creosote and petroleum (all at 7 lb. per cu. ft.), and creosote alone (mostly at 5 lb. per cu. ft.). In the creosote- and creosote-petroleum-treated sleepers less than 5 per cent. of the failures were primarily due to decay, whereas about 65 per cent. of the failures in sleepers impregnated with zinc chloride resulted from this cause.

33.36 : 33.52. MORĀTH, E. **Practical results in the preservation of wooden telegraph and transmission poles.** International Advisory Office on Wood Preservation, 9 Oranjestraat, The Hague, Holland. 1939. pp. 35.

Data supplied by post office, telegraph and telephone authorities and large power stations of 17 European countries are compared. The following is quoted from the author's summary:

Comparison of the quantities of poles, by species, as reported or estimated shows that the following proportions prevail:

	Per cent.
Pine	76
Fir	18
Larch	2
Oak	2
Chestnut	2
Total	100

and for the principal preservatives used:

	Per cent.
Coal-tar creosote	67
Corrosive sublimate	11·8
Copper sulphate	15·9
Basilit, Tanalith U-salts	3·1
Other preservatives	0·2
Untreated	2·0
Total	100

The average length of life does not admit of comparison because climatic conditions and types of timber in different countries vary greatly. The following averages should therefore be considered with due regard to these reservations.

Average life of poles

Treatment	*Years*
Coal-tar creosote	26
Corrosive sublimate	18·1
Copper sulphate	20·9
Basilit, Tanalith U-salts	16·2
Other preservatives	12
Untreated	9·5

The principal North American Telegraph Companies estimate the average life of creosoted poles to be about 50 years. This is undoubtedly due to the fact that in the U.S.A. generally a greater absorption is prescribed than in Europe. Most American

poles have 125 kg. per cu. m. (7·7 lb. per cu. ft.) injected into them and some American Companies specify an absorption of 160–190 kg. per cu. m. (9·9–11·8 lb. per cu. ft.).

Other points to be borne in mind are that untreated poles are usually either naturally resistant (e.g. Chestnut and Oak) or are not exposed to fungus attacks under certain climatic conditions, as in Scandinavia, and also that poles treated with copper sulphate are used chiefly in France and Switzerland where wood-destroying agents resistant to copper salts are less common and that a large proportion of copper-sulphate-treated poles receive additional protection by creosoting the ground-line area which is the most exposed.

Time has been too short to form any conclusive opinion on the value of U-salts.

In spite of these reservations it is clear from the data quoted that coal-tar creosote is by far the best preservative for poles and hence its use surpasses that of all other preservatives taken together.

33.36 : 33.52 (54). STEWART, D. **The use of treated wooden poles in India for electric distribution and service.** *Indian For.* 66, 1940 (146–54).

The author summarizes the contents of Morāth's 'Practical results in the preservation of wooden telegraph and transmission poles' [cf. preceding abstract] and contrasts the conditions in India with those in the United States and Europe as described in this report. Treated wooden transmission poles have been used in southern India for not longer than 10 years and 4 years in northern India. Coal-tar creosote and fuel oil have been found more satisfactory as preservatives than wood-tar creosote. The cold-water-soluble treatment of poles of Chir (*Pinus longifolia*) and Sal (*Shorea robusta*), patented in India in 1935, is not satisfactory and in consequence steel poles have come into use. It is concluded that the coal-tar creosote preservation will be satisfactory in India provided that the minimum absorption is 10 lb. of creosote plus 5 lb. of fuel oil per cu. ft. of wood.

33.36 : 33.52. HARKOM, J. F. **Preservative treatment of poles by end-boring.** Forest Products Laboratories of Canada, Ottawa. 1939. pp. 6. [Division of Wood Preservation.]

The technique consists in boring a number of holes 1⅛ in. in diameter and 8¼ in. deep in the butt end of poles, so far as possible in the sapwood; filling alternate holes with different water-soluble salts that will diffuse into the wood and there combine to form a toxic but relatively insoluble precipitate—thus preventing upward movement of the preservative to regions above the ground line; and plugging the filled holes with short corks. Bark should be left on up to the ground line and treatment should be carried out while the wood is still green. The method was evolved in an effort to meet the demand for a cheap butt treatment of Spruce and Pine telephone and transmission poles in regions where more durable poles or poles treated by the usual processes are unavailable or too expensive. As yet only preliminary tests have been made, but results appear promising although an insufficient number of holes per stem was used in the tests. Of the four combinations of chemicals used, the copper sulphate-sodium arsenite appears slightly better than the zinc chloride-sodium arsenite combination; zinc chloride-potassium ferrocyanide and copper sulphate-potassium ferrocyanide proved unsatisfactory. Further tests are to be made with the first-named combination, and a table is given to show the proposed number of holes per pole, quantity of each salt per hole, and cost of preservative per pole for poles of various diameters.

33.36 : 33.52 : 31.42. LYON, E. D. **Machine shave, sterilize, sapwood to stop Cedar pole sap rot.** *Elect. World, N.Y.* 112, 1939 (455–6, 515). [Commonwealth Edison Co., Chicago.] P.R.

Although penetration by creosote to a depth of ½ in. has been satisfactory in preventing decay in the ground-line region of Western Red Cedar poles, it has been found that of 535 poles examined, 48·4 per cent. showed sapwood rot in the above-ground portions. In most cases the decaying inner layers of sapwood were concealed by an outer shell of sound wood. It is recognized that sapwood decays more readily than heartwood, and since poles with thick sapwood proved the most susceptible to decay, the Commonwealth Edison Company has adopted the practice of shaving down the sapwood to less than ½ in., followed by a 15-minute immersion in creosote at 170–180° F. to preserve the remaining sapwood. For this purpose the company uses an electrically driven high-speed pole shaver, in which the pole is

revolved and fed past stationary shaving heads. The machine is capable of turning out a smooth, perfectly tapered pole in about 6 minutes.

33.36 : 33.52. COLLEARY, M. J. **The treatment of fence-posts with preservatives.** *Circ. Dom. For. Serv.* No. 56, 1939. pp. 17. [Forest Products Laboratories of Canada.]

A general, semi-popular review of the preservative treatment of farm fence posts with creosote oils or water-soluble salts. The preparation of the posts for treatment and the various preservative methods and equipment are described. Estimates are provided of the rough cost of treatment for posts of various common species, arranged in two groups according to their absorptive capacity, and tables are given to show (*a*) the estimated increase in life of fence posts treated by the various methods with creosote, zinc chloride, or sodium fluoride, and (*b*) the percentage of the cost of untreated posts that can be spent on treatment to increase their life by a given time without increasing the annual charge.

33.36 : 33.52 (931). **A note on the production of creosoted fence posts by the State Forest Service.** *N.Z. J. For.* 4, 1939 (257).

After posts of European Larch, Eucalypts, Austrian or Corsican Pine have been seasoned for several months, they are immersed first in hot creosote at 180°–200° F. and then in cool creosote, resulting in a minimum retention of half a gallon of creosote per cu. ft. of timber. The penetration and absorption of creosote by this method is similar to that obtained by the pressure process and a minimum average service life of 20 years is expected.

33.38. Charcoal Manufacture. Charcoal. Use of Wood in Power-Gas Generators. Producer Gas

33.38. WILLANS, K. W. **Charcoal manufacture.** *Wood* 5, 1940 (37–9).

A discussion of the uses of charcoal and the methods of manufacture.

33.38 (941). ROBERTS, R. P. **Producer gas in Western Australia.** *Aust. For.* 4, 1939 (112–4).

33.39. Manufacture of Sugar, Oils, Alcohol, and Vinegar from Wood

33.39 : 34.26 : 34.6. SCHOLLER, H. Die Chemie im Dienste der nationalen Roh- und Werkstoffversorgung. Holzverzuckerung. **[Chemistry in the service of national supplies of raw and industrial materials. The manufacture of wood sugar.]** *Chemikerztg.* 63, 1939 (737–40, 752–4). [G.] P.R.

33.4. *Converted Structural Timber*

33.4 : 31.27. TURNBULL, J. M. **Cross-section dimensional adjustment of substitute timbers.** *J. S. Afr. For. Ass.* 3, 1939 (111–2).

Where bending strength is important any departure from the standard in unit strength of a substitute wood must be allowed for by adjustment of the cross-sectional dimensions of members. The ratio existing between width and depth of members is significant and in maintaining it adjustment is complicated by the fact that strength does not vary proportionately with both width and depth. It varies directly and linearly with width and directly with the square of the depth. The formulae are given for the necessary adjustment.

33.4 : 33.8 (73). NEUBRECH, W. Le R. **American hardwood. Dimension, wall panelling and interior trim.** *Tr. Promotion Ser. U.S. Dep. Comm.* No. 201, 1939. pp. 40. P.R.

A popular review of the use of American hardwoods for 'dimension' products (semi-finished articles or finished parts needing only to be assembled) and interior house fittings.

33.5. *Roughly Converted Wood*

33.51. Pitprops and Sleepers

33.51 : 07.7. SPROT, M. **The Riddell pitprop gauge.** *Scot. For. J.* 54, 1940 (32–3).

Description of a portable gauge suitable for small estates.

33.7. *Firewood* [*Converted*]

33.7 : 07.7. **A new type of wood-burning stove.** *Nature, Lond.* 145, 1940 (218).

A stove developed by the Connecticut Forest and Park Association, in co-operation with Prof. L. E. Seeley, burns wood with an estimated efficiency of 90 per cent. It holds about 2¼ cu. ft., or slightly more than 50 lb., of wood,

which is estimated to generate about 40,000 B.T.U./hr. for an 8-hour period without attention. This is sufficient for two or three rooms in cold weather. In mild weather the stove will run more than 24 hours without attention. The novel feature is that predetermined amounts of air enter the main combustion chamber and a separate air supply mixes with the highly heated gases produced by the burning wood, which are burnt separately in special passage ways. This process gives high efficiency with a minimum of loss in soot, creosote, and ash.

33.8. *Other Manufactured Products*

33.8 : 12.2. NEUBRECH, W. Le R. **American Hickory handles.** *Tr. Promotion Ser. U.S. Dep. Comm.* No. 203, 1939. pp. 25. P.R.

A popular review of the use of Hickory for striking-tool handles, including notes on the properties of the wood, species used and their natural range, manufacturing processes, and the handle industry in general.

33.8 (43.7). DOUDA, V. **The use of wood in boat building.** *Lesnická Práce* 18, 1939 (591–7). [Cz.f.]

33.8. BROPHY, M. J. **Wooden tanks in industry.** *Circ. Dom. For. Serv.* No. 55, 1939. pp. 20.

Survey based on observations in 140 industrial plants of some 30 industries in Ontario and Quebec.

33.8 : 31.44 : 12.2. WADE, B. F. **Redwood tanks for the chemical plant.** *Tech. Bull. Calif. Redwood Ass.* No. 16–3. pp. 4. P.R.

Propaganda leaflet on the resistance of Redwood (*Sequoia*) to chemicals and on the use of Redwood tanks in the chemical industries.

33.8 : 33.0 : 35 : 12.2. **Sitka Spruce or approved substitutes (as used in aircraft parts).** *Air Ministry Material Specification* No. D.T.D. 36B. Dec. 1939. pp. 4. H.M. Stationery Office, London. 1940. P.R.

33.9. *Storage of Converted Timber*

33.9 : 33.52. LOSEBY, P. J. A. **A method of stacking poles in restricted yards.** *J. S. Afr. For. Ass.* 3, 1939 (110).

Forty per cent. more poles can be stacked in a given space by this method. One stack is built on another, the top one being reduced in width to allow room to work. For heavy poles an over-all height of 11 ft. should not be exceeded. To obtain proper drying, stacks are raised 9 in. above ground and the cross stickers are of a thickness equal to half the diameter of the thick end of the poles.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34 : 91 (91 : 92). COHEN, H. De economische beteekenis der boschbijproducten van de Buitengewesten. [**The economic significance of the minor forest products of the Outer Provinces, Dutch East Indies.**] *Tectona* 32, 1939 (883–919). [Du.e.]

In 1938 minor vegetable forest products accounted for some 13 million guilders of the total income of the Outer Provinces (Dutch East Indies exclusive of Java and Madura). The corresponding figure for wood and wood products was about 16 million guilders. Most of the minor products are exported, and in 1938 the value of such exports was 11·4 million guilders, or twice the value of wood exports and about one-eighth the value of all exports derived from native production. In view of these figures it is urged that more attention should be paid by the government to minor forest products. Government policy should aim at securing uniform quality, regular supplies, and the adoption of improved methods of collection.

34 : 98 (91 : 92). DREES, E. MEIJER. Herkomst, gebruik en bestemming der voornaamste boschbijproducten van Nederlandsch Indië. [**Sources, uses, and destination of the more important minor forest products of the Dutch East Indies.**] *Tectona* 32, 1939 (920–1017). [Du.e.]

A detailed account, with tables and separate sections for each individual product.

34.2. *Vegetable Products*

34.21 : 97.2 : 11.4 (73). CHANDLER, R. F. **The influence of grazing upon certain soil and climatic conditions in farm woodlands.** *Abstract* of paper read at a meeting of the Society of American Foresters, Dec. 1939, in *J. For.* 38, 1940 (228). [Cornell University.]

Results of a study of the effect of grazing on farm woodlands show that: (1) the organic content of the soil from the ungrazed areas averaged 8·5 per cent. whereas that from the grazed woodlands averaged only 6·4 per cent. ; (2) the average volume weight of the ungrazed soils

was 0·92, whereas that of the grazed soils was 1·15; (3) the average soil moisture content at the time of sampling was 14·4 per cent. on the ungrazed areas and only 10·6 per cent. on the grazed areas, or when expressed as relative wetness (moisture content as percentage of moisture equivalent), became 26·1 per cent. and 20·3 per cent. respectively; (4) the air and soil temperatures were lower on the ungrazed areas, but the differences between the means were small, being 2·1° C. for the air temperatures and 3·5° C. for the soil temperatures; (5) light intensity at ground level expressed as percentage of full sunlight was 3·03 in the ungrazed woods and 21·0 in the grazed woods; and (6) the relative humidity of the air, one foot above the ground, averaged 65·7 per cent. in the ungrazed wood lands, and 53·6 per cent. in the grazed areas. *From author's summary.*

34.24. FOSTER, G. A., and GARGATAGLI, F. Contribucion al conocimiento de las materias tanantes del Quebracho Colorado. [**Contribution to our knowledge of the tannic substances of Quebracho Colorado.**] *Maderil* 12 (137), 1939 (5–7). [Span.]

34.25 : 12.2. CHEVALIER, A. L'arbre à pain et ses congénères. Leur culture, leur utilisation, leur multiplication dans nos colonies tropicales, leur étude. [**The Bread-Fruit Tree and its congeners. Their cultivation, utilization, and propagation in our tropical colonies, and their study.**] *Rev. Bot. appl.* 20, 1940 (25–38). [F.] P.R.

34.26 (54.87). HAIGH, J. C. **Gums and resins.** *Trop. Agriculturist* 93, 1939 (217–8). L.S.

Brief notes on wild trees of Ceylon that deserve investigation as sources of gums or resins. The species dealt with are: *Limonia acidissima* L., *Lannea grandis* Engl., *Canarium zeylanicum* Bl., *Dipterocarpus zeylanicus* Thw., *Doona zeylanica* Thw., *Garcinia cambogia* Desr., *G. morella* Desr., *Semecarpus gardneri* Thw., *Vateria copallifera* Retz., and *Vatica chinensis* L.

34.26 : 12.2 (91–2). JAKOBS, H. Manila-copal. Opmerkingen betreffende de hoofdindeeling van recente copal in Loba & Melengket. [**'Manila copal'. Remarks on the broad classification of recent copals into 'Loba' and 'Melengket'.**] *Tectona* 33, 1940 (58–73). [Du.e.]

'Loba' and 'Melengket' copals, obtained by tapping various species of *Agathis*, are distinguished chiefly by the fact that the former is generally harder and less soluble in alcohol than the latter. These differences were previously assumed to be correlated with the length of the interval between tapping and gathering, but this has now been shown to have no influence upon solubility. The author suggests that some species of *Agathis* produce copals of the 'Loba' type while others generally yield 'Melengket', and as the two types are not entirely distinct, it would be advisable to abandon the present grouping and to classify copals purely by their solubility in alcohol. Copals from areas known to contain trees yielding a uniform product should not be mixed with other heterogeneous consignments.

34.26 : 12.2 (51 : 59.3–9). Huile d'abrasin ou 'wood oil'. [**Tung oil or 'wood oil'.**] *Rev. int. Bois* 7 (73–74), 1940 (13–7). [F.]

Tung-tree cultivation, the preparation of wood oil, Chinese exports—mainly to U.S.A. —and wood-oil prices and uses are discussed briefly. Recent attempts at Tung-tree cultivation and wood-oil production in Indo-China have been very successful, and it is hoped that Indo-Chinese wood oil will eventually take the place of Chinese supplies on the French market.

34.26 : 12.2 (73). ASHBY, M. **The Tung oil industry of the United States.** *Bull. imp. Inst., Lond.* 38, 1940 (5–32). [Plant & Animal Products Department, Imperial Institute.]

34.26 : 31.3 : 12.2. WIENHAUS, H. Flüchtige Stoffe aus Nadelhölzern. [**Volatile substances from conifers.**] *Holz* 2, 1939 (418–20). [G.g.] [Institut für Pflanzenchemie und Holzforschung, Tharandt.]

A concise review of the present state of knowledge with reference to *Podocarpaceae*, *Pinaceae*, *Taxodiaceae*, and *Cupressaceae*.

34.27. AMMAN, P. Le kapok. [**Kapok.**] *Rev. int. Prod. colon.* 15 (169–170), 1940 (1–3). [F.]

Data on the world production, trade, and utilization. A new English process makes possible the manufacture of cloth from Kapok on a commercial scale, and a large new market for Kapok fibre is therefore likely to develop.

34.28 : 33.35 : 12.2 (91.4). CORTES, R. T. **Air seasoning commercial Rattan.** *Philipp. J.*

For. 2, 1939 (329–39). [Bureau of Forestry, Philippines.]

Scraped Palasan (*Calamus maximus*) and Limoran (*C. ornatus*) require 5 weeks to dry to their minimum moisture content of 13·1 and 12·5 per cent. respectively. Unscraped material of these and other species takes much longer to attain a somewhat higher minimum moisture content, and fermentation occurred on a great majority of the unscraped pieces while seasoning. Data regarding the occurrence of, and suitable environment for, stain-producing fungus were noted.

34.6. *Utilization of Milling and Logging Waste*

34.6. CONDON, R. W. **Lignin and its commercial utilization.** *Univ. Wash. For. Cl. Quart.* 12 (2), 1938–39 (14–6).

Note on the uses of 'Raylig', a lignin road binder evolved from Hemlock lignin at the plant of Rayonier Inc., Shelton, Washington.

34.6 : 12.2. JONES, N. C. **A cold storage insulating material from forest waste.** *Chem. Ind.* 59, 1940 (69–70). P.R.

Shredded Redwood (*Sequoia*) bark is now widely used in the United States as an insulating material for cold-storage chambers. It has a thermal conductivity of 0·255 B.T.U. at a density of 5 lb. per cu. ft., and also fulfils other requirements for such materials, being reasonably free from shrinking and settling, durable, moisture- and fire-resistant, vermin-proof, odourless, and cheap to install.

34.6 : 33.32. HILL, A. C. **Recent advances in the utilization of lignin in waste sulphite liquor.** *Pulp Paper Mag. Can.* 41 (2), 1940 (148–50, 196–7).

Review, with 38 references to recent literature.

34.6 : 33.32 (71.4–7). PRINCE, J. B., and FELLOWS, E. S. **Some economic aspects of the use of sawmill 'waste' for chemical pulp in Quebec and the Maritime Provinces.** *Pulp Paper Mag. Can.* 41 (2), 1940 (185–90). [Forest Products Laboratories of Canada.]

34.6 : 12.2 (71.4–7). PRINCE, J. B. **Spruce 'waste' in the sawmills of Quebec and the Maritime Provinces.** Forest Products Laboratories, Ottawa. 1939 (?). pp. 10.

34.6 : 33.32 : 12.2 (71.4–7). FELLOWS, E. S. **The preparation and marketing of Spruce sawmill 'waste' for chemical-pulp chips in Quebec and the Maritime Provinces.** Forest Products Laboratories, Ottawa. 1939. pp. 16.

The first paper discusses the available quantities of sawmill waste, the problem of harmonizing the relative situation of the sawmilling and pulp industries, and the transport and preparation of sawmill waste for pulp. On the basis of a field survey made in 1939, it is estimated that a total of at least 440,000 cords of Spruce refuse would be available from Quebec and the Maritime Provinces. If it were found more economical to convert slabs and edgings, which are now used for lath, fuel, &c., into pulp chips, this total would be raised to about 600,000 cords. Past difficulties in making this method of utilization pay have been largely due to the small scale of such attempts, and it is believed that on a sufficiently large scale the method would be fully economical, provided that full co-operation could be secured between the two industries. The other two papers deal with the same problem in more detail.

35. SALE AND DISPOSAL OF FOREST PRODUCTS

35 (77). BRUNDAGE, R. C. **Timber marketing problems in the Central Hardwood Region.** *Abstract* of paper read at a meeting of the Society of American Foresters, Dec. 1939, in *J. For.* 38, 1940 (227–8). [Purdue University.]

37. FOREST TRANSPORT

37 : 07.7. LIÉNARD, U. G. Contribution à l'étude de la motorisation des exploitations forestières. Tracteurs et véhicules à chenilles. **[Contribution to the study of the mechanization of logging. Tractors and caterpillar vehicles.]** *Bull. Soc. for. Belg.* 47, 1940 (16–34, 59–64). [F.]

As far as extraction work within the forest is concerned, it appears, from recent dynamometric tests in the Soignies district, that caterpillar vehicles are superior to two-wheeled trucks and to carts with metal, solid rubber, or pneumatic tires, except on very muddy tracks where pneumatic tires of low air pressure requite relatively less power.

37 : 32.5 : 33.32 (71). WHITE, F. O., and ATKINSON, C. C. **A pulpwood transportation problem.** Woodlands Section, Canadian

Pulp & Paper Association, Montreal. [*Woodlands Section Index* No. 475 (B–8–e).] 1939. pp.7.

The description and plan of a conveyor and loading plant for removing pulpwood from the river to be loaded on trucks at a rate of at least 25 cords per hour. Experiments, over a period of one year only, with various types of trucks for hauling pulpwood, both in winter and summer, are discussed and the following points are summarized: (1) Of the types tested, the standard truck is the most economical if used only in summer, (2) there is no choice between the heavy 6-wheel truck and the semi-trailer in summer but the latter is of no use in winter, (3) the small 6-wheel truck does not compare favourably with the heavy machines in summer or winter but is more economical than the standard truck if it can be used for a reasonably long time in winter, (4) the heavy 6-wheel truck is the more economical if used in winter and summer, and the longer it is used in winter the greater is the economy for the year. Specifications are given for the trucks tested as well as figures on performance per trip, operating cost per cord, and operating cost per ton mile.

37 : 32.5 : 09.4 (73). **Motor truck logging costs. Case examples from the field.** *Timberman* 41 (5), 1940 (16–21).

38. FOREST CONSTRUCTIONAL WORKS. FOREST ENGINEERING

38. PEARSE, D. W. **Temporary timber chutes at De Hoek Plantation.** *J. S. Afr. For. Ass.*, 2, 1939 (72–4).

For use in conveying thinning material 5–10 in. diameter and 6–20 ft. long down grades 8° or greater. Cross pieces 3 ft. × 3 in. are laid 3 ft. apart on the ground, uprights of the same dimension are hammered 6 in. into the ground about 3 in. from the ends of the cross pieces and at a slight outward slope, and two pieces of maximum diameter of 3 in. are nailed to the uprights to form the sides. All this material is waste from thinnings. The floor is made of gum lath nailed to the cross pieces with thick end (not more than 1½ in. thick) down the slope.

38 : 37 (73). **Streamlined truck road construction.** *Timberman* 41 (5), 1940 (22–8).

38 (941). GODFREY, E. W. **New timber bridge over the Swan River at Fremantle, Western Australia.** *Aust. For.* 4, 1939 (86–8).

The bridge is 720 ft. long with a vehicular way 40 ft. wide and a footway 6 ft. wide. It is constructed on Jarrah (*Eucalyptus marginata*) piles driven 20 ft. into the river bed, and woods of *E. marginata*, *E. diversicolor* and *E. redunca* were used for all main structural parts.

38 : 33.36 : 33.4. APPLETON, W. **Treated timber and its use in the new composite highway bridges.** *Univ. Wash. For. Cl. Quart.* 13, 1939–40 (5–11). (West Coast Preserving Co.]

With reference to composite bridges of preservatively treated Douglas Fir and concrete.

4. PROTECTION

42. PROTECTION AGAINST INJURIES FROM INORGANIC AGENCIES

42.1. *Air Currents*

42.1 : 12.12 : 12.2. LINCK. Über das Reiben unterständiger Buchen an Kiefernstämmen. **[On the rubbing of Beech underwood against Pine trunks.]** *Forstwiss. Cbl.* 62, 1940 (15–9). [G.]

According to observations made near Güglingen, Württemberg, Pine stems are often seriously damaged by rubbing against Beech trees of the understorey. The Pines are moved by the wind and their trunks rub against the usually almost horizontal branches of the Beeches. To lessen the damage, either the injured Pines or the injury-causing Beech trees have to be removed unless it is possible to prune the latter. Where Beech is introduced artificially, the author recommends relatively close planting such as 4 × 4 m., in order to facilitate future removals of undesirable Beech trees and to prevent the Beech crowns from spreading.

42.3. *Precipitations and their effects*

42.3 : 11.6. HOLMES, M., and MAZE, W. H. **Rain run-off dispersion and soil conservation.** *Univ. Sydney Publ. Geogr.* No. 3, 1939. pp. 31.

42.3 : 11.6. JEPSON, H. G. **Prevention and control of gullies.** *Fmrs'. Bull. U.S. Dep. Agric.* No. 1813, 1939. pp. 59. [Engineering Division, Soil Conservation Service.]

42.3 : 11.6 : 01. BROWN, C. B., and BARNES, F. F. **Selected annotated bibliography on sedimentation as related to soil conservation and flood control.** U.S.D.A. Soil Conservation Service, Washington, D.C. June 1939. pp. 40. Sedimentation Division SCS–MP–20.

42.3 : 11.6 : 38. HENDRICKS, B. A., and JOHNSON, J. **The use of brush mats in road-erosion control.** *Res. Note Sthwest. For. & Range Exp. Sta.* No. 71, 1939. pp. 2.

Successful road bank protection trials with mats in the mountain brush zone of central Arizona. The mats were constructed of brush (*Quercus turbinella*, *Cercocarpus montanus*, &c.) and wire, and were made up in sections of convenient size. Before being covered, the slopes were sown with native grasses and low shrubs, which developed satisfactorily under the brush.

42.3 : 11.6 : 38. HURSH, C. R. **Roadbank stabilization at low cost. A progress report.** *Tech. Note Appal. For. Exp. Sta.* No. 38, 1939. pp. 20.

42.3 : 11.6 : 38. HARRISON, J. L. **River training works.** *Indian For.* 66, 1940 (154–62).

42.3 : 11.6 (54). SMYTHIES, E. A. **Bengal floods.** *Indian For.* 66, 1940 (67–70).

After detailed consideration of the Ganges basin it is concluded that the fundamental factor in the problem of the Bengal floods is lack of organized forest protection. An interim Ganges Flood Committee has been appointed to deal with the question of flood control.

42.3 : 11.6 : 38 (54). BREADON, G. W. D. **Bein River protection works, Shakargarh Tahsil. Mattress-facing of banks under erosion.** *Indian For.* 66, 1940 (232–4).

The growth of the shrub *Ipomoea carnea* and the use of its stem in the protection of river banks and for fencing.

42.3 : 11.6 : 96 (54.5). CHAND, K. **Counter-erosion and reclamation scheme in Gujrat District.** *Indian For.* 66, 1940 (30–7).

42.3 : 23.21 : 11.46. LIGON, W. S. **Influence of soil type and other site factors on the success of tree plantings for erosion control.** *Abstract* of paper read at a meeting of the Society of American Foresters, Dec. 1939, in *J. For.* 38, 1940 (226–7). [Soil Conservation Service.]

Observations of a large number of field and gully plantings of Pines and hardwoods indicate that Black Locust grows best on calcareous soils, soils of good drainage, aeration, and moisture-holding capacity, soils free from compact impervious layers and from a high content of concretionary material. Other hardwoods have not been successful in erosion control planting. Pines, particularly the two-needle species, are least exacting and will thrive on soils more acid, droughty and infertile than those suitable for Black Locust. The results of Pine and Locust plantings are discussed for certain soil types and series.

42.4. *Shifting Sands*

42.4 : 96 (931). HARRISON-SMITH, J. L. **Sand dune reclamation.** *N.Z. J. For.* 4, 1939 (227–35).

The sand dunes in Te Kopuru, to the south-west of Dargaville in Auckland district, are formed by sand drifting from old elevated dunes, which in the past had been fixed by native vegetation. Two plants used to stop sand movement are Marram grass (*Psamma arenaria*) and *Lupinus arboreus*, which is sown two or three years after the Marram is planted. After another three years trees may be planted to form a permanent vegetation. In order to establish the transplants, lines have to be cut and re-cut through the lupins. Tree species favoured are *Pinus pinaster* and *P. muricata*, mainly for windbreak, and *P. radiata*, *Cupressus macrocarpa*, *Eucalyptus botryoides*, and other useful species. Details are given of the work so far undertaken.

42.5. *Chemical influences*

42.5 : 12.12 : 21.3. STARR, G. H. **Treating deciduous trees for chlorosis.** [*Abstract* of paper read at the 31st annual meeting of the American Phytopathological Society.] *Phytopathology* 30, 1940 (23).

Chlorotic deciduous trees in Wyoming have been treated with ferric phosphate, injected into holes bored in the trunks. Results are highly satisfactory, but the optimum dose has not yet been determined.

42.5 : 12.12 : 21.3 (77.4). KREAG, K. K. **Chlorosis studies in Michigan.** *Trees Mag.* 2 (4), 1939 (13–16). Exp. Sta. Rec. 82 (212).

43. FOREST FIRES

43 : 11.1–2 (492). STOFFELS, A. De samenhang tusschen het optreden van bosch- en heidebranden en meteorologische factoren in Nederland. [**The relation between the occurrence of forest and heath fires and meteorological factors in Holland.**] *Ned. Boschb.-Tijdschr.* 13, 1940 (89–95). [Du.e.]

A statistical examination of data on forest and heath fires in Holland during the period 1926–35 shows clearly that rainfall and humidity are important contributing factors. With the restricted figures available it has not been possible to establish a statistical correlation for temperature. During the period mentioned the total number of fires was 2,546, and of these 1,490 can be attributed with reasonable certainty to definite causes, distributed in the following percentages: carelessness 41·6, children 21·7, incendiarism 19·4, railways 15·0, lightning 1·4, and military exercises 0·9 per cent.

43 : 11.41 : 12.19. BEADLE, N. C. W. **Soil temperatures during forest fires and their effect on the survival of vegetation.** *J. Ecol.* 28, 1940 (180–92). [Department of Botany, University of Sydney.]

A method for measuring soil temperatures during forest fires is described and data are given showing the temperatures under various conditions. During natural fires on the sandstone of the central coastline of New South Wales, the surface temperature varies from 81 to 213° C. At a depth of 1 in. the temperature does not exceed 67° C. The probable maximum temperature during a severe fire at a depth of 1 in. is 111–114° C.; at 3 in. 59–67° C. Below this level, the soil temperature is not sufficiently high for a long enough period to harm plant organs. Under extreme conditions (if trees were entirely burned), the temperature at a depth of 1 in. exceeds 250° C., while at a depth of 1 ft. the temperature is 43–50° C. High percentages of water in the soil greatly retard the conduction of heat. There is not a redistribution of water in the soil after fire; the water is lost to the atmosphere and does not pass downwards and condense. Fires have no appreciable effect on the physical properties of the soils investigated.

Fires do not kill the vegetation, and many woody plants are capable of regeneration from aerial stems and lignotubers. Plants which possess lignotubers are rarely killed. After fire, the number of seedlings which appears is very large. This can be attributed to the desiccation and dehiscence of woody fruits and to the ability of the seeds to resist high temperatures. The seeds of all native plants investigated can resist a temperature of 110° C. for 4 hours in the dry condition.

The effect of high temperatures on seeds in wet condition is discussed. Soft seeds are killed after immersion for 5 minutes in water at 60–80° C. Hard seeds can withstand the temperature of boiling water for as long as 70 min. when the percentage germination is reduced from 98 to 3 per cent. Boiling water increases the permeability of the testa, thereby enabling the seed to germinate. *Author's summary.*

43.1. *Protective Measures*

43.1 (54.5). PRING, N. G., and BAKHSH, A. **Fire protection in high hill forests.** *Indian For.* 66, 1940 (70–9, 135–46).

The region under consideration lies within the high hills extending from the Tons River through the Punjab Hill States Agency, Siraj Mandi and Kulu to Chamba. Forests of *Pinus excelsa* and *P. longifolia* in these hills are highly inflammable. The authors discuss incendiarism and its results, causes for grievance against the forest authority, and suggestions towards the solution of this problem. Part II deals with fire-prevention treatment, certain protection measures being described.

43.1 (71). RABOUILLE, G. La lutte contre les incendies de forêts au Canada. [**Forest fire control in Canada.**] *Rev. Eaux For.* 77, 1939 (893–909). [F.]

43.1 (71). BEALL, H. W. **Tables for estimating the tracer index from early afternoon weather readings. Table for diurnal hazard variation. List of forest types of eastern Canada showing the fire-hazard table to be used for each type.** *Suppl.* to *For.-Fire Res. Note* 5, 1939. pp. 20. [Dominion Forest Service.]

43.1 (71). WRIGHT, B. S. **Preliminary fire-hazard studies on cut-over lands of eastern Canada.** *For.-Fire Res. Note* 7, 1939. pp. 20.

43.1 (71.21). BEALL, H. W. **An investigation of the reliability of eastern forest-fire hazard tables in Manitoba and Saskatchewan.** *For.-Fire Res. Note* No. 9, 1939. pp. 18.

There appears to be no justification at present for compiling a separate hazard index table for use in the forests of these provinces. However, the intensity of fire-control action required at a given degree of hazard may not be quite the same in the West as in the East, as the probability of fires starting, which is perhaps the main factor governing detection and some other pre-suppression activities, need not necessarily be the same for the two regions.

43.1 (71.5). BEALL, H. W. **Preliminary forest-fire danger tables and fire-control administration plans for the New Brunswick Limits of the Bathurst Power & Paper Company, Limited.** *For.-Fire Res. Note* 8, 1939. pp. 32.

43.1 (73). FUNKE, F. W. **Forest Service landing fields.** *Fire Control Notes* 4 (1), 1940 (38–42). [Region 5, U.S. Forest Service.]

43.1 (76). BICKFORD, C. A., and BRUCE, D. **A tentative fire-danger meter for the Longleaf-Slash Pine type.** *Occ. Pap. Sth. For. Exp. Sta.* No. 87, 1939. pp. 6. [Southern Forest Exp. Sta.]

43.1 (76.2). BICKFORD, C. A., and BRUCE, D. **Fire-discovery time in the Longleaf-Slash Pine type.** *Occ. Pap. Sth. For. Exp. Sta.* No. 88, 1939. pp. 5. [Southern Forest Exp. Sta.]

43.1 : 07. CURRY, J. R., and FONS, W. L. **Forest-fire behavior studies.** *Mech. Engng. N.Y.*, 1940 (219–25). (Repr.) [California Forest & Range Exp. Sta.]

Brief survey of methods and instruments employed in the U.S.A.

43.1 : 07. SIMPSON, A. A. **The burned-over area as a classroom in fire-control training.** *Fire Control Notes* 4 (1), 1940 (1–3).

43.1 : 07.7. **The Bosworth trencher.** *Woodlands Rev.* 11 (5), 1940 (12).

The Bosworth fire trencher has a rotary sweeper consisting of iron bars that swing freely from the bottom of a vertical shaft driven by a small air-cooled motor. This device is mounted in an open, wheelbarrow-like frame with a towing bracket in front and handles for the operator behind. The whole machine weighs 96 pounds. At normal operating speed, the iron bars turn at 800 r.p.m., cutting a trench 11½ in. deep and scattering the earth 6–10 ft. away from the sides. Since the bars are free-swinging, they do not catch in obstacles. Speeds of ¾–3 chains per minute have been achieved in tests.

43.1 : 07.7. WICKLUND, H. T. **Trencher field tests.** *Fire Control Notes* 4 (1), 1940 (25–8). [Region 1, U.S. Forest Service.]

On the whole, the Bosworth trenchers recently built by the Forest Service and distributed to various parts of the country, have proved satisfactory in the field. Possibilities for various mechanical improvements are discussed.

43.1 : 07.7. SNOW, E. A. **The Herbert fire plow.** *Fire Control Notes* 4 (1), 1940 (43–5). [Harney National Forest, Region 2, U.S. Forest Service.]

Details of a low-cost, man-pulled fire plough weighing only 55 pounds when equipped with a drag chain and hand-holds. Tests through several types of light ground cover, using 8–10 C.C.C. enrollees for power, gave an average performance of about 60 chains of fire line per hour. The plough can be carried by two men and is claimed to be ideal for the Ponderosa Pine type.

43.1 : 07.7. EVERTS, A. B. **The dry-ice tanker takes to wheels.** *Fire Control Notes* 4 (1), 1940 (4–8). [New England Forest Emergency Project, Connecticut.]

Dry ice (CO_2) was used as a pressure medium for expelling water in a 200-gallon fire-fighting unit constructed by the author. Water was discharged for 50 ft. throughout the test. The total weight of the unit, including 200 gallons water, was 3,805 pounds. It is estimated that on an order of a dozen or more units the cost should not run over $400. The unit can be hauled behind any car equipped with a ball-and-socket trailer hitch, and should prove a useful implement in fighting small fires.

43.1 : 07.7 (942). RANKIN, M. A. **The fire fighting truck in South Australia.** *Aust. For.* 4, 1939 (89–96).

The standard vehicle is a 4-ton truck equipped with a 500-gallon tank, a power (centrifugal) pump with outlet through two

'live' reels, and a hand pump, all fixed to a steel frame. Improvement of truck performance in loose sand has been obtained by changes in gear ratio and the size of the wheels. The range of delivery can be varied from 2·5 to 28·8 gallons per minute with a stream distance up to 80 ft. The water supply of the trucks depends on a system of 1,000-gallon overhead tanks situated at accessible points in the plantations, and the truck tank can be filled from these at the rate of 80 gallons per minute. *From author's summary.*

43.1 : 11.1–2 : 01 (71). **Definitions of terms for use in preparing local weather forecasts and in marking forecast accuracy.** Revised, 1939. pp. 4. [Dominion Forest Service, Ottawa.]

43.1 : 11.12 (74.2). LANSING, L. **Weather preceding forest fires in New Hampshire.** *Bull. Amer. met. Soc.* 20, 1939 (10–26). [Fox Research Forest, Hillsboro, N.H.]

In this region special precautions are indicated after a precipitation deficit of about 70 per cent. or more for 7–10 days, combined with much clear weather (70 per cent. upwards of the possible sunshine), low relative humidity (below 65 per cent. at 8 a.m. and below 45 per cent. at noon), high winds for several days, and maximum temperatures above the normal.

43.1 : 11.44. WRIGHT, J. G., and BEALL, H. W. **The effect of non-aqueous volatile matter in forest-fire fuels upon apparent moisture contents obtained by oven-drying.** *For.-Fire Res. Note* No. 4, 1938. pp. 25. [Dominion Forest Service.]

Tests at Ottawa showed that the effect was of little significance.

43.1 : 46. PADDOCK, W. R. **Dogs as a fire-prevention tool in the South.** *Fire Control Notes* 4 (1), 1940 (23–5). [Division of Operation, Region 8, U.S. Forest Service.]

Experience with trailing dogs has shown that they are useful in solving fire cases, and that the knowledge of their availability is a definite deterrent to incendiarism.

43.1 : 61. MOESSNER, K. E. **Consistent plotting of additional coverage.** *Fire Control Notes* 4 (1), 1940 (9–13). [Superior National Forest, Region 9, U.S. Forest Service.]

A mathematical method for determining, for relatively flat or gently undulating country, how much seen area can be added at different elevations by means of towers.

43.2. *Insurance of the Forest*

43.2. BRICHET, L. Contribution au problème de l'assurance des bois contre l'incendie. [**Contribution to the problem of forest fire insurance.**] *Bull. Soc. for. Belg.* 47, 1940 (108–24). [F.]

Suggestions for the creation of a mutual forest fire insurance company in Belgium. One of the main obstacles to the development of forest fire insurance in Belgium is the lack of accurate and sufficiently detailed fire-hazard data.

44. PROTECTION AGAINST DAMAGE BY HARMFUL PLANTS

44.3. *Fungi*

44.3 : 12.12 : 12.2 (68.9). LEACH, R. **Biological control and ecology of *Armillaria mellea* (Vahl) Fr.** *Trans. Brit. mycol. Soc.* 23, 1939 (320–9). R.A.M. 19 (311–3).

With particular reference to tea plantations in Nyasaland and the ring-barking of native trees capable of spreading infection in them. Nearly all the native tree species in the tea-growing districts of Nyasaland are potential hosts of the fungus, though the roots of a few species only are commonly associated with root rot of tea. The trees most dangerous as sources of infection are those whose roots die very slowly after felling, such as *Afrormosia angolensis* and *Parinarium mobola*.

44.3 : 12.12 : 12.2. HOWARD, F. L., and CAROSELLI, N. **Bleeding canker of Maple.** [*Abstract* of paper read at the 31st annual meeting of the American Phytopathological Society.] *Phytopathology* 30, 1940 (11).

Cankers exuding a reddish ooze on species of Maple in Rhode Island were found to be caused by *Phytophthora cactorum*. Leaf wilting and die-back of branches were associated symptoms. Injection with a di-nitro-cresol compound appears to be a promising means of control.

44.3 : 12.12 : 12.2 (77.5). CHAMBERS, E. L., and KOUBA, T. F. **White Pine blister rust in Wisconsin.** *Bull. Wis. Dep. Agric.* No. 204, 1939 (37–48).

44.3 : 12.12 : 12.11 : 12.2. RIKER, A. J., and KOUBA, T. F. **White Pine selected in blister-rust areas.** [*Abstract* of paper read at the 31st annual meeting of the American

Phytopathological Society.] *Phytopathology* 30, 1940 (20).

Seedling trees and grafts have been obtained from parent trees that appear to be immune from infection by *Cronartium*. Immunity tests will be carried out when the trees are old enough.

44.3 : 12.11 : 12.12 : 12.2. GOIDÀNICH, G., and AZZAROLI, F. Relazione sulle esperienze di selezione di Olmi resistenti alla grafiosi e di inoculazioni artificiali di '*Graphium ulmi*' eseguite nel 1938. [**An account of experiments on the selection of Elms resistant to graphiosis and of artificial inoculations with *G. ulmi* carried out in 1938.**] *Boll. Staz. Pat. veg. Roma* (*n.s.*) 19, 1939 (222–40). [It.] R.A.M. 19 (124).

The resistance of *Ulmus pumila* to *Ceratostomella ulmi* was confirmed. A high degree of resistance was also shown by 'Villagrappa 3' (a strain of *U. campestris*), by hybrids of *U. pumila* derived from crosses with *U. campestris* and *U. montana*, and by the C. Buisman Elm grafted on *U. hollandica* or *U. pumila*. There was evidence that to maintain resistance in grafted Elms the grafts must be made on a resistant stock.

44.3 : 45.3 : 33.36 (74.6). FISHER, H. J. **Report on commercial insecticides and fungicides 1939.** *Circ. Conn. agric. Exp. Sta.* No. 136, 1939. pp. 10.

The results of official analyses made at the Connecticut Agricultural Experiment Station are tabulated.

45. PROTECTION AGAINST DAMAGE BY ANIMALS

45.3. *Insects*

45.3 : 12.12 : 12.2 : 13.2. HENRY, H. K. **The Fir bark louse in New York.** *Notes For. Invest.* No. 35, 1939. pp. 2.

June and early September are the best times to examine Balsam Fir, particularly large living trees, for the white waxy threads which indicate the presence of this insect. Living Balsam Fir that are infested should be cut close to the ground, preferably in the winter, and the bark burned if possible. In an infested stand it is advisable to cut all trees 10 in. or more in diameter. Examination of stands should be frequent and salvage operations begun as soon as infestation is found.

45.3 : 12.12 : 12.2 : 13.2. OUDEMANS, T. C. Het voorkommen van *Epiblema proximana* H.S. op *Abies grandis* Lindl. en de mogelijke bestrijding daarvan. [**The occurrence of *E. proximana* on *A. grandis* and its possible control.**] *Ned. Boschb.-Tijdschr.* 13, 1940 (109–12). [Du.]

Trees of *Abies grandis* were attacked by the needle-mining moth *Epiblema proximana* at 'Schovenhorst' from 1930 to 1932 and again in 1938. Since the larvae pupate and overwinter in the soil cover, two methods of tilling were tried in 1938 as control measures, (*a*) deep digging, and (*b*) treatment with the Finnish 'roller harrow'. Trap cages were set over the soil in 1939, but neither in these nor in the open were adults seen, and in the autumn no damage to the trees could be observed. Though by no means conclusive, the results are regarded as promising.

45.3 : 12.12 : 12.2 : 13.2 (931). CLARK, A. F. **A survey of the insect pests of Eucalypts in New Zealand.** *N.Z. J. Sci. Tech.* 19, 1937–38 (750–61). O.R.S.

The following important pests of Eucalypts are dealt with: *Eriococcus coriaceus* Mask.; *Gonipterus scutellatus* Gyll.; *Paropsis dilatata* Er.; *Rhicnopeltella eucalypti* Gahan. The geographic range and hosts in New Zealand, the life-history, control measures, and economic significance of each species are described. A number of pests of minor importance are referred to briefly. The only method of insect control possible has been the introduction of insect parasites. The insects dealt with in this survey form a complex, the activities of which are seriously detrimental to the growth of Eucalypts in New Zealand, especially in such provinces as Canterbury and Otago where all the members of the complex are to be found. The control of *Eriococcus coriaceus* is one of the outstanding examples of successful parasite introduction, and the results so far obtained with *Gonipterus scutellatus* are very encouraging. *From author's summary.*

45.3 : 12.12 : 12.2 : 13.2 (74.2). BROWN, W. E., and PAQUETTE, R. G. **Spruce sawfly infestation as indicated by cocoon population.** *Fox Forest Notes* No. 19, 1939. p. 1.

45.3 : 12.12 : 12.2 : 13.2. HENRY, H. K. **The Pine Spittle-bug in New York.** *Notes For. Invest.* No. 36, 1939. pp. 2.

Planting of Scots Pine should be avoided in heavily infested areas. Where plantations are established, trees should be at least 8 ft. apart, one dimension of the plantation should be under 200 ft., and the distance between two plantations of Scots Pine or between a plantation of this species and the margin of an old deciduous forest should not be less than 100 ft. In young plantations opening of the stand should start as soon as possible by thinning, removal of deciduous undergrowth, high pruning of crop trees and low pruning of other residuals. Thorough circulation of air is essential in the control of this insect. Spraying with pyrethrum extract, at the rate of 1 pint to 50 gallons of water, late in June, and banding with tangle-foot have been found effective methods for control on individual trees.

45.3 : 12.12 : 13.2 : 12.2. HOFMANN, C. Die Bekämpfung des Kiefernspanners (*Bupalus piniarius* L.) mit dem Kontaktstaubemittel 'Nemotan'. **[The control of the Pine looper moth (*B. piniarius*) with the contact dust insecticide 'Nemotan'.]** *Anz. Schädlingsk.* 16, 1940 (3–5). [G.] [Institut für angewandte Zoologie der Bayer. Forstlichen Versuchsanstalt, München.]

Power dusting with 'Nemotan' and with 'Detal' during August 1939 in Bodenwöhr, Regensburg region, confirmed the view that 'Nemotan', while quite safe to foliage and warm-blooded animals, is as effective as 'Detal' in controlling the looper. The action of both dusts was hampered by unusually low air humidity during the period of application.

45.3 : 12.12 : 12.2 : 13.2. BEAL, J. A. **The Black Hills beetle, a serious enemy of Rocky Mountain Pines.** *Fmrs'. Bull. U.S. Dep. Agric.* No. 1824, 1939. pp. 21.

Notes on *Dendroctonus ponderosae* Hopk.

45.3 : 12.12 : 12.2 : 13.2 (492). Circulaire en mededeelingen 1938 van het Comité ter Bestudeering en Bestrijding van Insectenplagen in Bosschen. **[Circular and communications issued in 1938 by the Committee for the Study and Control of Forest Pests.]** *Tijdschr. ned. Heidemaatsch.* 51, pt. 2, 1939. pp. 8. [Du.] Repr. R.A.E. A28 (109–10).

Most of the work done by the committee was concerned with *Diprion pini* L. The dust mixture used against the larvae is stated to contain an inert carrier, finely ground derris powder with a rotenone content suited to the stage of development of the larvae, and a pyrethrum preparation that serves as an irritant and is added because gregarious larvae are more sensitive when exposed individually than when grouped together, and come into contact with the poison more readily if disturbed.

45.3 : 13.1 : 12.2 : 13.2 (410). HANSON, H. S. **Further notes on the ecology and control of Pine beetles in Great Britain.** *Bull. ent. Res.* 30, 1940 (483–536). [Farnham House Laboratory, Imperial Institute of Entomology.]

With special reference to *Myelophilus piniperda* and *M. minor*. It has been determined that thin-barked material of small diameter from thinning operations can be left on the ground without risk of a bark-beetle outbreak. There is less risk of a bark-beetle outbreak if thinning is done in the summer. Where trapping is necessary the use of billets is preferred and the preparation of these is described. The results are given of a recent survey of bark-beetle population size, and distribution in Great Britain. Measures are discussed for the control of bark beetles during all stages of the crop's development.

45.3 : 12.12 : 12.2 : 13.2 (43.1–5). THALENHORST, W. Zur Ausbreitung und Bekämpfung der Douglasienwollaus. **[On the spread and control of *Chermes cooleyi*.]** *Dtsch. Forstw.* 21, 1939 (844–5). [G.] R.A.E. A28 (73).

Notes on the distribution in Germany of *Chermes* (*Gilletteëlla*) *cooleyi* Gill. on *Pseudotsuga taxifolia*. Infestation is likely to continue to spread in favourable weather, and outbreaks may occur where Coccinellids and Syrphids are not numerous. The removal of heavily infested trees is not always justified, especially as nicotine sprays have been found effective on trees up to about 12 ft. high. It is generally impracticable to spray taller trees in closed stands, and spraying is economically justified only when it is desired to check serious foci of infestation.

45.3 : 12.12 : 12.2 : 13.2 (946). EVANS, J. W. **Oak insects.** *Tasm. J. Agric.* 10, 1939 (199–205). L.S.

Oaks (*Quercus pedunculata*) grown in Tasmania are damaged by *Asterolecanium variolosum* and *Myzocallis annulata*, which kill large branches and sometimes the whole tree. Indirect injury is also caused by a sooty-mould fungus that lives on the excreta of the insects, especially of *M. annulata*, and covers the limbs

of the tree with a black deposit that hinders respiration. Control of both insects may be achieved by dormant sprays, but this measure is seldom practicable. The parasitic wasp *Habrolepis dalmanii*, obtained in 1931–33 from New Zealand, is now spreading in Tasmania and appears likely to be effective against *A. variolosum*. Two parasites of *M. annulata*, *Aphelinus flavus* and *Trioxys aceris*, occur in Tasmania but were not intentionally introduced. Both overwinter inside the parasitized aphids on fallen leaves, hence better control is to be expected where the leaves are allowed to lie where they fall. *T. aceris* is hyperparasitized by a minute wasp, but it is not yet known how far this reduces the effectiveness of the primary parasite. Other insects, chiefly ladybird beetles, also feed on the aphids. Oak in Tasmania is a host for several other insects, but none of these cause extensive damage.

45.3 : 12.12 : 12.2 : 13.2. COLLINS, C. W. **The Elm leaf beetle.** *Leafl. U.S. Dep. Agric.* No. 184, 1939. pp. 6. [Division of Forest Insect Investigations, Bureau of Entomology and Plant Quarantine.]

Popular leaflet on *Galerucella xanthomelaena* (Schr.).

45.3 : 12.12 : 12.2 : 13.2. JONES, T. H. **Elm bark beetles.** *Leafl. U.S. Dep. Agric.* No. 185, 1939. pp. 8. [Division of Forest Insect Investigations, Bureau of Entomology and Plant Quarantine.]

Popular leaflet on *Scolytus multistriatus* Marsh. and *Hylurgopinus rufipes* (Eich.).

45.3 : 12.12 : 12.2 : 13.2 (492). FRANSEN, J. J. Het gebruik van vangstammen bij de iepenspintkeverbestrijding. [**The use of trap logs in the control of Elm bark beetles.**] *Tijdschr. ned. Heidemaatsch.* 51, 1939 (141–56, 177–96). [Du.] R.A.E. A28 (110–1).

An account of work in Holland, in connexion with the control of Elm disease, on the use of trap logs against *Scolytus scolytus* F. and *S. multistriatus* Marsh. Experiments by the author suggest that the beetles breed only in trees that are dead and have no sap flow. Thick logs were preferred as trap logs, because (*a*) the beetles could bore in thick bark without touching the sap-exuding cambium, and (*b*) such logs remained moist and attractive for longer periods. The most satisfactory were logs 8–16 ins. in diameter. Healthy trees felled in winter were unsuitable as trap logs in the following spring, but were made attractive by watering with a solution of common salt, gas-water, or sodium fluosilicate, or by covering the ends with asphalt. The logs, which should be in use from early May to late September, should be laid on supports in shady places and periodically turned, as no galleries are made on the sunny side of logs or where they rest on the ground. To prevent emergence of the adults, logs infested by both species should be barked, and the bark burnt, about 4 weeks after the formation of the first galleries. Many female beetles were trapped before they made galleries by covering logs with butter muslin smeared with strips of an adhesive, which remained sticky for about a month, and longer if the logs were protected by a roof.

45.3 : 13.2 (76.3). SMITH, M. R. **The Texas leaf-cutting ant (*Atta texana* Buckley) and its control in the Kisatchie National Forest of Louisiana.** *Occ. Pap. Sth. For. Exp. Sta.* No. 84, 1939. pp. 11. [Bureau of Entomology and Plant Quarantine, U.S.D.A.]

As a result of recent experiments recommendations are made for control with carbon bisulphide.

45.3 : 13.2. SPEYER, W. Beitrag zur Frage der Arsen-Nachwirkungen bei Raupen. [**On the question of the after-effects of arsenic upon caterpillars.**] *Anz. Schädlingsk.* 16, 1940 (14–15). [G.]

The experiment described showed that *Cheimatobia brumata* caterpillars from stands in Hanover, which had been regularly treated with arsenic since 1930, did not exhibit either increased or lessened resistance to the poison.

45.3 : 13.2. BURGESS, A. F., and BAKER, W. L. **The gypsy and brown-tail moths and their control.** *Circ. U.S. Dep. Agric.* No. 464, 1938. pp. 37. [Bureau of Entomology & Plant Quarantine.]

45.3 : 13.2 (47.2–6). TSIOPKALO, V. L. **On control measures against the Spanish Fly (*Lytta vesicatoria* L.).** *Plant Prot.* No. 19, 1939 (157–63). [R.] R.A.E. A28 (131).

Laboratory experiments on insecticides against *L. vesicatoria*, which defoliates trees (particularly Ash) in Russian field shelterbelts. Calcium arsenite at about 1½ lb. per acre gave complete mortality of males and females in 1·5 and 2·1 days respectively, and was the most effective substance tried.

45.3 : 24.4 : 13.2 (47.6). MOISEEV, A. E. **Control of the may-beetle in protective strips of forest trees.** *Social. Grain Fmg.* 1939 (3), (132–6). [R.] R.A.E. A28 (71).

An account is given of damage by *Melolontha hippocastani* F. to field shelterbelts in south-eastern Russia. The reproductive and feeding habits of this insect are described. As the beetles feed before oviposition and oviposit more than once, dusting should be an effective auxiliary control measure. Aeroplane dusting should be practicable, since the strips of trees could be covered in a single flight. Dusting should be carried out immediately after the emergence of the adults and repeated if necessary during the second period of feeding.

5. MENSURATION. INCREMENT. YIELD

52. MEASUREMENT OF TREES

52.1. *Thickness and Diameter*

52.1 : 52.2 : 12.2. HARDING, J. H. **Jarrah mid girth tables.** *Aust. For.* 4, 1939 (82–5). [Forests Department, Western Australia.]

A study to determine the value of correlating girth loss at mid-log under bark, with girth at breast height over bark and log length, as a basis for estimating girth under bark at mid-log in the measurement of the volume of standing trees.

52.4. *Volume. Volume Tables*

52.4. HAMPEL, R. Die Genauigkeit von Formeln zur Messung liegenden Holzes. [**The accuracy of formulas for the measurement of felled timber.**] *Cbl. gesamte Forstw.* 66, 1940 (8–16). [G.]

A theoretical proof that Huber's formula, which is most commonly used for measuring felled stems either intact or in sections, is not less precise than the more complicated formulae of Smalian, Hossfeld, Newton-Riecke, Gauss-Simony, and Schiffel.

52.4. KORSUŇ, F. **Shustov's formula.** *Lesnická Práce* 18, 1939 (441–5). [Cz.g.]

Shustov's formula (*Lesnoe Khozyaystvo, Moscow* 1932), according to which the stem volume h can be calculated from $h = K \times d_{1.3} \times d_{\frac{1}{2}} \times v$, where $d_{1.3}$ is the diameter at 1·3 m. height, $d_{\frac{1}{2}}$ the diameter at half the stem height, v the stem height, and K an empirical constant, was tested by the author on 100 Spruce and 100 Beech stems. These investigations, combined with previous ones by Zachariew in Bulgaria (*Gorski Pregled, Sofia* 1933) and Shustov's own work, showed that the constant K is approximately 0·53 for Pine, Oak, and Beech, and 0·55 for Spruce and Fir. The error rarely exceeds $\pm$ 3 per cent. for individual standing or felled stems.

52.4 : 12.2 (91). LANDON, F. H. **The compilation of volume tables.** *Malay. Forester* 9, 1940 (33–6).

Includes volume tables for Kapur (*Dryobalanops aromatica*), Meranti tembaga (*Shorea leprosula*), Meranti sarang punai (*S. parvifolia*), and Red Meranti (various species of *Shorea*). The figures given relate to the volume of the merchantable bole under bark; no deduction is made for hollow or unsound logs.

52.4 : 12.2 (77.1). DILLER, O. D., and KELLOGG, L. F. **Local volume table for Yellow Poplar (*Liriodendron tulipifera*) in Stark County, Ohio.** *Tech. Note Ohio agric. Exp. Sta.* No. 1, 1940. p. 1.

52.4 : 12.2 (74.6). HICOCK, H. W., RHODES, A. D., and OLSON, A. R. **Volume tables for plantation-grown White Pine, *Pinus strobus* L., in Connecticut.** *Bull. Conn. agric. Exp. Sta.* No. 427, 1939. pp. 14.

56. INCREMENT. DIAMETER, HEIGHT, AND VOLUME INCREMENT

56–7. FRANÇOIS, T. Production et variation de volume apparente. [**Yield and variation in apparent volume.**] *Bull. Soc. for. Franche-Comté* 23, 1939 (255–71). [F.]

A discussion of errors that may arise from the assessment of volume increment by means of periodical enumerations of the growing stock. The errors are very small if the growing stock is divided into 1 cm. diameter classes, as in sample plot technique, but in enumerating entire woodlands it is usual to work with 5 cm. diameter classes. In this case considerable over- or under-estimates may occur, and errors up to 2 cu. m. and more per ha. per annum were noted in some of the woods enumerated by the author.

56–7 : 24.2. CILLIERS, A. C., and WYK, J. H. VAN. **A mathematical expression for the**

growth of trees in their dependence on time and density of stocking. *Ann. Univ. Stellenbosch* 16, Sec. A, No. 2, 1938. pp. 36. [University of Stellenbosch.] L.S.

A differential equation of growth is derived, giving the relation between increment, growing space, and time for a given species [*Pinus pinaster*] in a given locality. It is established that for two suppressed even-aged stands of different densities, the basal-area increments taken at the same age from the date of suppression in each stand are directly proportional to their respective growing spaces. The increments in an unthinned even-aged stand under suppression decrease with time in a geometrical progression. With the aid of data from a single local stand, graphs are drawn for a series of stands of different densities, giving the relation between logarithmic increment and time. From these graphs a new graph of logarithmic increment is obtained for a stand thinned at definite intervals. From the last graph a tentative thinning schedule is drawn up. *From authors' summary.*

56–7 : 12.2 (45). STEFANO, M. del R. La *Pseudotsuga douglasii* Carr. nelle Foreste Demaniali di Idria. [***Pseudotsuga douglasii* in the State Forests of Idria.**] *Riv. for. ital.* 2, 1940 (86–95). [It.]

Mainly increment data for young stands.

56 : 12.11 : 12.15 : 12.2. LITTLEFIELD, E. W. **Comparative height growth of different Larches five years after planting.** *Notes For. Invest.* No. 27, 1939. pp. 2.

The following results were noted at the end of the fifth growing season:

Species or Race of Larch	*On moderate south-west slope, protected, and fairly well drained*		*On steep, very exposed north slope*	
	Per cent. survival	*Average height*	*Per cent. survival*	*Average height*
European (Scotland)	67	5·2	87	6·1
European (Silesia)	57	4·9	90	5·1
Japanese	44	5·0	83	6·5
Dahurian	33	2·2	76	2·4

The planting was done in New York State near Albany at an elevation of 2,000–2,300 ft. The 'grub-hoe slit' method was used in all cases.

57. RATE OF GROWTH. YIELD. INCREMENT AND YIELD TABLES

57 : 07. WIEDEMANN. Untersuchungen der Preussischen Versuchsanstalt über Ertragstafelfragen. [**Investigations by the Prussian Research Institute on questions relating to yield tables.**] *Mitt. Forstwirt. Forstwiss.* 10, 1939 (401–38). [G.g.]

Schwappach's yield table for Pine of 1908 and for Oak of 1920, and Wiedemann's yield table for Beech of 1931 were found to correspond completely with yield data from recent investigations. Wiedemann's yield table for Spruce of 1936 appeared to under-estimate the increment of stands under 40 years, but was quite correct for more mature stands.

Recent yield tables prepared for even-aged mixed stands include Bonnemann's table for Pine-Beech stands [*For. Abs.* 2 (32)] and Christmann's tables for 1st-quality Oak-Beech and Pine-Spruce stands. Such tables cannot, of course, cover all types of mixture occurring in practice, and as the proportion of species varies so does their increment and standing volume. On the other hand, the total increment of the stand remains the same within wide limits. The possibility of adopting unified yield tables for the whole of Germany was examined. Since data from various parts of the country showed a great similarity with regard to height growth and volume increment, it is suggested that the use of Prussian yield tables which are based on very large material should be generalized for the whole of Germany, except for Spruce of the Alpine region and for Oak of the warmer parts of Southern Germany. Quality classes in such unified yield tables should be expressed in terms of increment, e.g. quality class 7 = 7 solid cu. m. increment per ha. per annum for a given set of conditions.

The paper also contains tables showing gross incomes (based on 1913 prices) from various species for the usual rotations.

57 : 11.46 : 12.2 (43.1–5). SCHOBER, R. Standort, Form und Rinde der Lärche in Hessen. [**Site, form, and bark of Larch in Hesse.**] *Mitt. Forstwirt. Forstwiss.* 10, 1939 (263–311). [G.g.] [Institut für Forsteinrichtung und Ertragskunde der Forstl. Fakultät der Georg-August-Universität Göttingen.]

The soils occupied by Larch stands were mostly loamy, slightly to distinctly acid, and contained nutritive substances in an easily

soluble form. The timber (Derbholz) volume of pure or mixed Larch stands over 100 years old varied from 400 to 860 solid cu. m. per ha. The average height of the Larch in these stands was 29 to 37 m. Detailed data on stem form were obtained by measuring in sections a large number of sample trees. These measurements showed that the stem form of mature Larch in Hesse was very similar to that of Pine in Württemberg (Zimmerle: Beiträge zur Biologie der Kiefer in Württemberg. *Mitt. Württemb. forstl. Vers-Anst.* 1933). The taper of the Larch trees examined was greater outside than inside bark. The root swelling always reached above breast height and increased with tree height up to 7 m. for the tallest trees. The form quotient decreased with increasing tree height from 0·74 to 0·61. The tree form factor based on cross-section at 1-20th the tree height, proved a useful expression of stem form, while the artificial form factor was quite unsuitable. Schiffel's Larch Volume Table III, 1905, based on height, diameter and form quotient, was found to allow of very accurate estimates. Detailed investigations on bark distribution showed that the stem volume of all the stands examined included, on the average, 20 per cent. bark.

57 : 32.3 : 12.2. MITSCHERLICH. Sortenertragstafeln für Kiefer, Buche und Eiche. **[Assortment yield tables for Pine, Beech, and Oak.]** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (484–568). [G.g.]

57 : 32.3 : 12.2. MITSCHERLICH. Sortenertragstafel für Fichte. **[An assortment yield table for Spruce.]** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (569–83). [G.g.]

Tables giving the percentage distribution of the stand volume into the various assortments as recognized in Germany, for different quality and age classes and for several geographic regions within that country.

6. MANAGEMENT. WORKING PLANS. SURVEYS

61. SURVEYING. MAPPING. PHOTOGRAPHY

61 : 01. HALL, W. **Plotting vertical air photographs by radial intersection (planimetry only).** Air Survey Section, British Columbia Forest Service, Victoria, B.C. 1939. pp. 28.

61 : 07.7. FIELD, R. H. **Instrumental aids to photogrammetry.** *Engng. J., Montreal* 22, 1939 (391–9). [Physical Testing Laboratories, Department of Physics and Engineering, National Research Council, Ottawa.]

A conspectus of instruments and methods.

61 : 07.7. MATĚJŮ, K. **Shortening the plumb-line.** *Lesnická Práce* 18, 1939 (435–41). [Cz.g.]

Description of a simple automatic device for adjusting the length of plumb-lines by pressing a button which releases a spring mechanism.

61 : 09.4 (485). SWEDEN. Riksskogstaxeringen av Västernorrlands läns skogar år 1938. **[State Forest Survey of the forests of Västernorrland, 1938.]** *Skogen* 27, 1940 (27–47). [Sw.]

An official preliminary report, with tables giving comprehensive data on the growing stock, its former treatment, and suggested measures for the future. Special care has been taken to distinguish public, company, and private forests. The accuracy of the results is discussed.

61 : 12.19.2 (728.2). KINLOCH, J. B. **Mapping vegetational types in British Honduras.** *Carib. For.* 1 (2), 1940 (1–4). [E. span.]

The field data obtained from a 3 per cent. enumeration survey, which is based on ecological factors, is being correlated with aerial photographs taken at a 21,000 ft. flying height. Certain vegetational types such as open grassland, Slash Pine forest, Mangrove, low scrub-swamp forest, rain forest, and new cultivation are readily distinguished on the photographs, while factors that aid in the differentiation of associations within the rain forest include geology, slope, aspect, relative height of canopy, abundance of canopy palms, and the general appearance of the photographic matrix.

61 : 51 : 07.7. LYSAGHT, J. F. **The advantages of the topographic Abney level for forest work.** *N.Z. J. For.* 4, 1939 (249–52).

The Abney hand level fitted with a topographic arc graduated for a base of 66 ft. has been found to be quick and simple in use, and of sufficient accuracy in measuring the height of trees, setting out of grades, and in chaining

cruise lines and boundaries where it is necessary to determine and make allowance for slope.

64. DESCRIPTION OF SITE. ASSESSMENT OF QUALITY

64 : 11.3 : 11.4 : 12.2 (74.6). LUNT, H. A. **Soil characteristics, topography and lesser vegetation in relation to site quality of second-growth Oak stands in Connecticut.** *J. agric. Res.* 59, 1939 (407–28). [Connecticut Agricultural Exp. Sta.]

Seventy-six plots in even-aged, second-growth Oak stands (principal species: *Quercus alba*, *Q. borealis* var. *maxima*, *Q. velutina*, *Q. coccinea*, *Q. montana*, with a few *Q. bicolor* and *Q. palustris*), distributed throughout Connecticut, formed the basis of this study. The soils were prevailingly acidic, largely fine sandy loam in texture, and relatively low in fertility. Site indices ranged from 30 to 83 and averaged 59·7; nearly three-quarters of the plots had a site index of 50–70, and slightly over three-quarters were between 20 and 60 years old. *Q. velutina* averaged highest in site index, and *Q. montana* lowest. The average height and diameter at breast-height were 53·2 ft. and 7·98 in. respectively. When all plots were included, correlations between site index and surface-soil characteristics were mostly either absent or slightly inverse. In some cases, factors such as high water table or seepage from higher ground were clearly more important than the soil itself; if such plots were omitted the inverse correlations disappeared and a low but significant correlation was revealed between site index and total nitrogen. Soil-series groups showed no correlation with site index. Plots having a mull condition averaged the highest site index, and the fibrous-mor-over-podsol type the lowest. Topographically, there was little correlation, except that plots at the foot of a slope had an average site index considerably greater than those on hilltops; level well-drained areas were slightly superior to level areas with poor drainage. Site index was inversely correlated with the presence of *Vaccinium* and *Gaylussacia*, the mosses, and, to a certain extent, *Hamamelis*, but there was evidence of a direct correlation with *Rubus*; otherwise the ground cover appeared to be of little value in indicating site quality. *From author's summary.*

64 : 57. BURGER, H. Ertragsfähigkeit der Standorte und ihre Holzerzeugung. **[Yield capacity of sites in relation to their timber production.]** *Schweiz. Z. Forstw.* 91, 1940 (70–3). [G.]

A strict comparison of the yield capacity of different sites must be based on the dry weight of organic matter produced per unit area and time, mere timber production data not being sufficient. This is illustrated by comparing the following two tables.

Table based on Romell's data for a 200- to 250-year-old, somewhat open conifer stand in northern Sweden (*Svensk bot. Tidskr.* 1939).

Annual production per hectare	*Expressed in* Dry weight	Solid cu. m. of timber	*Per cent.*
Timber . . .	600 kg.	1·5 cu.m.	29
Needles . . .	700 kg.	1·7 cu.m.	33
Vaccinium and *Hylocomium*	800 kg.	2·0 cu.m.	38
Dry matter increment of the association	2,100 kg.	5·2 cu.m.	100

Table based on the author's own data for a 98-year-old, very dense Spruce stand at Tablat, St. Gallon.

Annual production per hectare	*Expressed in* Dry weight	Solid cu.m. of timber	*Per cent.*
Timber . . .	5,800 kg.	13·9 cu.m.	71
Needles . . .	1,800 kg.	4·3 cu.m.	22
Ground flora . .	600 kg.	1·4 cu.m.	7
Dry matter increment of the association	8,200 kg.	19·6 cu.m.	100

65. DESCRIPTION OF GROWING STOCK

65. GRAY, H. R. **Stem distribution in irregular forests.** *Aust. For.* 4, 1939 (101–3).

The author suggests that the middle size classes are the most stable elements of the natural crop under any conditions, and where fires have reduced the total cover the heaviest loss is suffered by the unstable elements at the extremes of range and size. Comments are made on the management significance of stem distribution and the distribution of size classes in a managed irregular forest. [*For. Abs.* 1 (196).]

65. PATRONE, G. Osservazioni sul calcolo della provvigione normale. **[Observations on**

the calculation of normal stocking.] *Riv. for. ital.* 2, 1940 (145–9). [It.]

A discussion of the effect of thinning intensity and other factors on the theoretical distribution by age classes of the growing stock for a number of tree species.

66. POSSIBILITY. YIELD REGULATION

66. FRÜCHTENICHT and HENNIG. 10 Jahre praktische Kontrollwirtschaft auf einem Waldgute. II. [**Ten years of practical yield regulation, based on the 'Méthode du Contrôle', on a forest estate.**] *Mitt. Forstwirt. Forstwiss.* 10, 1939 (231–53). [G.]

Detailed description of management and report of satisfactory results from an estate of some 400 acres in the Göttingen district.

67. WORKING PLANS

67 (54.3). ROBINSON, A. J. **Working plan for the Yeotmal Forest Division, Western Circle, C.P. and Berar, 1938-39 to 1947-48.** Govt. Printing, Nagpur, C.P. and Berar, India. 1939. Vol. I, pp. 239; Vol. II, pp. 258.

67 (59.1). ATKINSON, D. J., and ALLSOP, F. **Working plan for the Insein Forest Division for the period 1937-38 to 1946-47.** Supt., Govt. Printing and Stationery, Rangoon, Burma. Vol. II, pp. 268.

67 (59.1). MOREHEAD, F. T., and MAXWELL, H. A. **Working plan for the Bhamo portion of the Bhamo Forest Division, Northern Circle, Burma, for the period 1937-38 to 1950-51.** Supt., Govt. Printing and Stationery, Rangoon, Burma. 1939. Vol. I, pp. 111; Vol. II, pp. 200.

67 : 97.2 (485). Sockenplaner för skogsvården. [**Parish working plans.**] *Skogen* 27, 1940 (93–7). [Sw.]

In 1938 the Gävleborg county forestry board carried out strip surveys in two of the parishes under its supervision. A working plan has now been compiled for one of these, the parish of Mo, and will be distributed to the forest owners, who are almost exclusively farmers. Details are given of the forest conditions in this parish and of the measures proposed in the working plan.

8. FOREST ADMINISTRATION

83. FINANCIAL AND TIMBER RESERVES

83 (494). BADOUX, H. Quelques constatations au sujet des caisses forestières de réserve en Suisse. [**Some notes on the subject of forestry reserve funds in Switzerland.**] *J. for. suisse* 91, 1940 (69–74). [F.]

Such funds exist in many cantons for communal, corporation, and sometimes State forests. In the canton of Soleure they are obligatory for all communal forests and in the Zurich canton for all corporation forests. The reserve funds have proved a useful instrument for tiding over periods of unfavourable market conditions.

84. BOOK-KEEPING. ACCOUNTING

84. MANTEL, W. Die Fortbildung der forstlichen Buchführung. [**The development of book-keeping in forestry.**] *Allg. Forst- u. Jagdztg.* 116, 1940 (4–15). [G.]

Criticism of present German methods with suggestions for simplification. The paper refers mainly to book-keeping in State forestry.

9. FOREST POLICY

91. BENEFICIAL EFFECTS AND ECONOMIC SIGNIFICANCE

91 (71). CAMERON, D. R. **National Forestry Program.** *For. Chron.* 16 (Spec. No.), 1940 (53–6).

91. DAVEY, R. **Woods and the landscape.** *Quart. J. For.* 34, 1940 (17–22).

The author discusses questions of topography, siting, form and colour of trees, variations of form and foliage, and the place of conifers and hardwoods in the problem of harmonizing woods and landscapes.

91 : 6. MOORE, E. B. **Forest and wildlife management in the South Jersey Pine barrens.** *J. For.* 38, 1940 (27–30). [New Jersey Department of Conservation and Development.]

The soils supporting the Pine barrens are,

in general, sandy, highly acid and of low fertility, and have a definite and relatively low limit to forest productivity despite fairly intense silvicultural practice. Small game, which may be considered a supplementary management base, is limited in this region by lack of food. Present wildlife management efforts are being directed towards the breaking up of the large uniform forest units by means of 25-foot strips, and small artificial fields, thus creating conditions favourable to the development, breeding and movement of small game. The strips are cleared, ploughed and sown with native herbaceous flora and will be maintained in the early stages of plant succession. 100-foot safety strips are constructed as a fire-precaution measure, on each side of all roads running through the area.

92. FOREST LAW

92 : 34.21 (481). HØDAL, A. Skog og beite. **[Forest and pasture.]** *Tidsskr. Skogbr.* 48, 1940 (79–89). [Nor.]

A summary of certain recommendations made in the report of a Pastures Committee, set up in 1935 by the Norwegian Department of Agriculture to examine the pasture problem and to suggest alterations in the existing laws affecting grazing, particularly on forest land held under common rights. The proposed changes are designed to expedite the voluntary adjustment of common rights by extinction or commutation and to allow for the establishment of local boards to assess grazing damage and assist in the regulation of grazing. In addition to the legislative changes, it is suggested that much could be done by administrative measures, such as the encouragement of closer co-operation between local agricultural and forestry societies, education in modern pasturing methods, pasture research, and grants to aid the establishment of systematically managed pastures. It is emphasized throughout that combined forestry and pasturing is an uneconomical form of land use that should not be allowed to persist.

92 (82). ARGENTINA. Fué creada la Division Forestal dependiente de la Dirección de Agricultura. **[Creation of the Division of Forestry under the Ministry of Agriculture.]** *Maderil* 12 (138), 1939 (12, 25–6). [Span.]

Text of the decree by the President of Argentine. The programme of the newly formed Division includes an aerial survey of the country's forest resources.

92 : 93 (931). FOSTER, F. W. **Timber rights under New Zealand coal mining laws.** *N.Z. J. For.* 4, 1939 (199–204).

Coalmining laws are distinct from mining laws in New Zealand. Exercisable timber rights are implied in coal lease grants. Timber on a coal lease, if not required by the Crown, may be used in and about the coalmine on the lease, and no timber royalties are payable. Such rights are less complex than those exercisable under the mining law, and less obstructive to forest management. Actually most coalmine timber is obtained (1) under general timber rights under forest or land laws or (2) from private timber owners. *From author's summary.*

92 : 93 (931). FOSTER, F. W. **Timber rights under New Zealand mining law.** *N.Z. J. For.* 4, 1939 (236–48).

Further notes on their history [cf. *N.Z. J. For.* 4 (2–15)], and a summary of the present position. *Author's summary.*

94. OWNERSHIP, ACQUISITION AND ALIENATION

94.3 : 97.2 (43.1–5). WENNING. Genossenschaftliche und privatbäuerliche Waldungen in der Wirtschaft einzelner Gemeinden Mittel- und Norddeutschlands. **[Corporation and private farm woodlands in the economy of some parishes in Central and North Germany.]** *Mitt. Forstwirt. Forstwiss.* 10, 1939 (169–215). [G.]

Using production, income and expenditure data from the town forest of Münden (Hanover) and from several small, individually or co-operatively managed peasant woods in the surrounding country, the author shows the inadequacy of present management of farm forests, and especially of those which do not form part of a co-operative body. He urges co-operation or, at least, adjustment of boundaries to overcome the frequently unnecessary division of woodland into small lots, and a stricter state control over peasant forestry, which would benefit both the farmers and the national economy.

94.3 : 92 : 96 (485). WARD, G. B. **State control of cutting on private forests in Sweden.** *J. For.* 38, 1940 (48–51). [Southern Forest Exp. Sta.]

A brief description of Swedish forest legislation, its enforcement and some results obtained from it.

94.3 : 92 (498). CERNESCU, T. Istoricul pădurilor composesorale din Ardeal şi dispoziţiunile legislaţiei silvice in legătura cu administrarea lor. [**History of the collective forests of Transylvania and legislation concerning their administration.**] *Rev. Pădurilor* 52, 1940 (95–8). [Rum. f.]

94.3 : 92 : 96 (74). **Regulation of cutting on privately owned forest lands in New England.** Committee on Private Forests, New England Section, Society of American Foresters. *J. For.* 38, 1940 (10–2).

The main object of regulated cutting in New England would be to maintain or increase forest land production, particularly in certain forest types such as the White Pine, and in areas where the owners tend to harvest immature stands for fuel-wood. However, the regulation of cutting is a matter of relatively small importance in this region and should not be enforced on private owners unless compensations are available toward the payment of the immediate costs of regulation.

95. FOREST TAXATION. FOREST LOANS

95 : 92 (493). GATHY, H. Le régime fiscal des propriétés boisées en Belgique. [**Taxation of wooded estates in Belgium.**] *Bull. Soc. for. Belg.* 47, 1940 (74–9). [F.]

95 : 96 : 72 (73). HAMMAR, C. H., and MUSSMAN, A. H. **Interest and credit costs in forest restoration.** *J. For.* 38, 1940 (37–43). [University of Missouri.]

A proposal for low-cost financing of the regeneration and restoration to timber production of forest lands that have been depleted of their growing stock and are often of low quality. It is proposed that such lands under private ownership should be organized into large conservation districts and leased under government control for their development and management under the U.S. Forest Service, the government to pay the owner some predetermined return at the time of harvest and also to make some payment in lieu of taxes to the local government. An important factor in the development of this scheme is to obtain the necessary money at a low rate of interest. This entails the floating of subsidized loans at a favourable time when debenture rates as well as labour and equipment costs are low. It is further suggested that no margin charges to cover costs of financing be made until the forests are placed on a sustained-yield basis. The advantages of this proposal are listed and discussed.

96. PROTECTION FOREST. POLICY REGARDING DEFORESTATION, AFFORESTATION, AND FIXATION WORKS

96 (729.2). SWABEY, C. **Reservation policy in Jamaica.** *Carib. For.* 1 (2), 1940 (10–12). [E. span.]

The suggested forest classification includes: (1) On land suitable for agriculture, (*a*) protection forests for soil and water conservation, and (*b*) production forests for local fuel supplies. (2) Protection or production forests on land unsuitable for agriculture.

97. RELATION OF FOREST TO AGRICULTURE, MOUNTAIN PASTURE, AND INDUSTRY

97.1–2 : 92 : 34.21 (54.7). GARLAND, E. A. **Grazing control in Bombay.** *Indian For.* 66, 1940 (213–9).

A detailed analysis of, and possible alternatives to, the first draft rules [*Indian For.* 65, 1939 (445–52)] for grazing control. These rules have now been abandoned by the Government and a fresh draft, more suitable to the public demand, is being prepared.

97.1–2 : 92 (73). CHAPMAN, H. H. **Why the Cooperative Forest Restoration Bill should not pass.** *J. For.* 38, 1940 (231–4). [Yale School of Forestry.]

97.1–2 : 92 (73). HAMMAR, C. H. **An economic view of the Cooperative Forest Restoration Bill.** *J. For.* 38, 1940 (235–9). [University of Missouri.]

97.1–2 : 92 (73). FAIRCHILD, F. R. **Comment (on the Cooperative Forest Restoration Bill).** *J. For.* 38, 3, 1940 (240). [Yale University.]

97.1. PEARSON, G. A. **Forest land use.** *J. For.* 38, 1940 (261–70).

97.1 (91.1). FLEMMICH, C. O. **History of shifting cultivation in Brunei,** 1906-1939. *Malay. Forester* 9, 1940 (13–8).

97.2 (71.3–7). RICHARDS, E. S. **Farm woodlots in eastern Canada.** Ottawa. 1939. pp. 120.

A popular bulletin, prepared under the direction of the Associate Committee on Forestry of the National Research Council of Canada, on the silviculture, management, and utilization of farm woodlands in the Maritime Provinces, Quebec, and Ontario.

97.2 (73). UNITED STATES. **Policies and procedures for the Farm Forestry Program of the Department of Agriculture under the Co-operative Farm Forestry Act.** U.S.D.A. Farm Forestry Committee, Washington, D.C. Revised ed. 1940. pp. 6.

97.2 : 6 (78.6). ANDERSON, I. V. **The farm woodlot: a source of permanent income if handled wisely.** *Bull. Univ. Mont.* No. 367, 1939. pp. 15. [Northern Rocky Mt. Forest & Range Exp. Sta.]

A popular bulletin on the handling of Ponderosa Pine woods on Montana farms. A diagram and table are included to assist the farmer in distinguishing the economic tree grades as a guide to correct cutting.

97.2 : 7 (73). MATTOON, W. R. **Forestry and farm income.** *Fmrs.' Bull. U.S. Dep. Agric.* No. 1117, revised ed. 1938. pp. 32.

98. STUDY OF THE TIMBER MARKET

98.1 : 09.4 (78.6 : 79.6–7). WHITNEY, C. N., and HUTCHINSON, S. B. **Consumption of timber products in the Northern Rocky Mountain Region.** *For. Surv. Release Nth. Rocky Mt. For. & Range Exp. Sta.* No. 17, 1940. pp. 71.

This region extends over 110 million acres of which 24 million acres bear commercial forests. The population is 834 thousand. It is a heavy wood-consuming area, 172 million cu. ft. of timber products being used annually. Of this total 43 million cu. ft. are of lumber and 109 million cu. ft. of fuelwood, including slabs and dead wood. The remaining 12 per cent. of the total consumption includes fence posts, mine timbers, pulp logs, poles, piling, hewed ties, &c.

2 : 02 (729.7). MARSHALL, R. C. **Silviculture of the trees of Trinidad and Tobago.** Oxford University Press, London. 1939. pp. 247.

The introduction to this book presents an outline of the physiography and vegetation of Trinidad and Tobago, and is followed by silvicultural notes on some 330 species of trees and palms found in Trinidad and Tobago, including a number of exotics. The book is illustrated with 16 photographic plates and 28 drawings.

The scope of the work is clearly described by the author in his preface: 'The book summarizes, from a silvicultural standpoint, the results of eleven years' work, during which the writer had the honour to be in charge of the Forest Department of Trinidad and Tobago. . . . It is, in effect, the outcome of copious note-taking for many years'. As such it clearly forms an invaluable groundwork on which to base and build up further progress in silvicultural research.

The lapse of time between the author's departure from Trinidad and the publication of his book has, unfortunately, caused a certain amount of the material to be out of date at the time of its appearance. Some of the botanical nomenclature already needs amendment: Galba, for example, is cited as *Calophyllum brasiliense* var. *antillanum* (Britton) Standl. whereas the Trinidad species is in reality *Calophyllum lucidum* Benth.

To the local user the local names may be misleading. Some of those invented by the author are distinguished by inverted commas, though no explanation is given for the sign, but others are not distinguished from genuine local names.

To the ecologically minded, whose interest is stimulated by the introduction to this book, Marshall's 'Physiography and Vegetation of Trinidad and Tobago', published by the Oxford University Press, is commended.

Finally, the last paragraph of the author's preface can be heartily endorsed. 'Although this book refers particularly to Trinidad and Tobago, the species described therein have, in the aggregate, a wide range covering a large geographical region ranging from the southern portion of the United States of America, through the West Indies and Central America, to the tropical zone of South America. It is not claimed that the information obtained in Trinidad and Tobago is necessarily of wide application in all these varying countries, but it is probable that much of the work carried out in Trinidad and Tobago may be of value in the wider sphere'.

R. L. BROOKS.

02. ILLICK, J. S. **An outline of general forestry.** 3rd edition. Barnes and Noble, Inc., New York. 1939. pp. 297.

This is a book with which foresters in the U.S.A. are doubtless already well acquainted. There is probably nothing like it in the forestry literature of any other country. It is at once a history of forestry in the U.S.A., and an encyclopedia of information on current forestry matters in that country, as well as a general outline of forest management, utilization and economics. Naturally, as so wide a range is covered, no one subject is treated intensively, but even the most learned non-American forester could not read through this book without gaining some fresh item of information.

The book is intended as a general introductory textbook to forestry and related activities in the U.S.A. Questions are set, and a list of relevant literature references is given at the end of each chapter. Except for the short chapter dealing with forestry in other countries the literature referred to is entirely American. Even so it is of considerable extent and many of the references could not possibly be studied adequately in a course based upon this book. Doubtless, however, it is intended to act as a work of reference as much as a teaching handbook.

There is a great deal to be said for a book of this kind, both for the study of foresters beginning training, as well as for more general reading and reference. The reader obtains a broad view of forestry which enables him to see it as a whole, in relation to other activities. He is also able to acquire a vast amount of general forestry knowledge which more specialized and intensive studies commonly fail to give. Such a work is, in fact, one of the necessities in the production of educated foresters as contrasted with highly qualified technicians. It is so much easier to produce the latter, that the need for the former is often overlooked. From this point of view it is well

worth the study of those whose concern is with forestry teaching and propaganda.

W. R. Day.

33.35. Ihne, A. Le séchage des bois. [**The seasoning of timbers.**] 3rd edition. Dunod, Paris. 1940. pp. 266 [F.]

This work is a very comprehensive study of the principles and general problems connected with the seasoning of wood. The author first deals shortly with the structure of wood and then proceeds to give detailed descriptions of methods for the determination of moisture content.

Hygrometry, moisture movement, and the theory of wood drying are next considered, and in the opinion of the reviewer the number of mathematical calculations and theoretical data introduced here might well tend to confuse the average reader.

The chapters that follow on air speeds and kiln-drying schedules contain some excellent information which shows that the author thoroughly appreciates to what extent such factors as air movements, wood thickness, &c. affect the manner in which wood dries under any given set of air temperature and humidity conditions. It is of interest to note on page 143 that the moisture content values of timber found to be most suitable for various purposes, presumably in France, are unusually low as compared with those corresponding to similar conditions in England. For instance, the moisture content value of 8 per cent., recommended for aeroplanes, is well below the permissible figure in this country. The chapter dealing with types of kilns and kiln design contains much useful information, but it is doubtful whether the highly technical chapter on air volumes and heat quantities will be of interest or assistance to more than a very limited number of kiln users. It may be said, however, that even when many of the theoretical calculations and examples cannot be fully understood by the non-technical reader there is ample information of a more practical nature contained in this book to recommend it well to anyone interested in the drying and seasoning of timber.

W. C. S.

6 (74.9). Moore, E. B. **Forest management in New Jersey.** State of New Jersey Department of Conservation and Development, Trenton, New Jersey, U.S.A. 1939. pp. 55.

Forests cover 2,000,000 acres, or 46 per cent. of the State of New Jersey, on land mostly unsuited to agriculture. Practically all of the forests have been damaged by fire and destructive cutting, and there is much tax delinquency. These forests can, however, be restored rather easily through fire protection and simple silvicultural methods, as natural regeneration occurs abundantly except in the more denuded areas of the Pine region. In the northern part of the State, which has been glaciated, several species of Oak predominate, with Maple, Ash, Hickory, Tulip (*Liriodendron tulipifera*), Birch, and other species in mixture. Here the group selection system is recommended. In the middle portion of the State, on the more level unglaciated inner coastal plain, with forests of about the same species but on better soils and in smaller blocks, the shelterwood compartment method is advised. The southern New Jersey Pine region, covering 1,300,000 acres of poor sandy soils, is still a wilderness in spite of being within two hours' motoring distance of New York City. Large stretches bear only Scrub Oak (*Quercus ilicifolia*) and scattered Pitch Pines. Restoration here is beyond the power of private owners, and must be undertaken by the State, which has already acquired four state forests. In the less badly damaged parts, the seed-tree method, leaving 10 to 20 seed trees per acre, has resulted in satisfactory regeneration. Southern White Cedar (*Chamaecyparis thyoides*) forms dense stands in the swamps of the Pine region and is easily reproduced after opening the stand. Increase of wildlife (game and other animals) through appropriate silvicultural measures, especially cleared strips and openings, is stressed. Sustained yield by individual holdings is in general impossible owing to their small size, but may be attained by organizing co-operative units as in New York State and elsewhere. The brief but adequate instructions for carrying out the measures recommended, supplemented by the offer of free advice, together with the State's fire-protective system and the State forests and research, comprise a unified effort to make the forests produce income to the owners and revenue to the State. The appendix includes yield tables for hardwoods, and other information. The photographs are well chosen and clearly reproduced.

Barrington Moore.

12.12. Smith, K. M. **The virus.** Cambridge University Press. 1940. pp. 176.

This book is not written specially for foresters but for any who wish to keep up-to-date their general knowledge of scientific matters. Its aim is to give an account, which is understandable by the general reader, of viruses, of the relationship between them and their hosts, together with a description of some of the important virus diseases and an account of the means by which they are controlled. The author is to be congratulated on having achieved his purpose so well. His style is good, easily understood and there are not many occasions on which the lay reader will have to stop to consider the meaning of the text or to consult a technical dictionary.

Virus diseases are so common and important that no one lacks experience of them, though, perhaps, many still have no idea which diseases are caused by viruses. It is sufficient to name some of the common human virus diseases, such as common cold, measles, mumps or warts to realize this. They are, similarly, of great interest and importance to the economic pathologist and the farmer, as complaints such as foot-and-mouth disease, rabies, psittacosis and the various agricultural plant virus diseases (e.g. potato leaf-roll or tobacco mosaic) remind one. There are, however, few recognized virus diseases of trees, the best known probably being yellows of peach and spike disease of sandal. The latter is, perhaps, the only recognized virus disease seriously affecting economic forestry.

This scarcity of virus tree diseases may be accounted for largely by our ignorance and may well be remedied in due course. In the meantime, it can do nothing but good to have some idea of the characteristics of virus diseases, especially in view of their wider spread and general importance. This book may be recommended to all who wish to obtain such knowledge. It is both a good account of viruses and their activities, and interesting, attractive reading. Moreover, in dealing with his subject the author demonstrates clearly the essence of scientific method in thought and investigation. At the present time this is, perhaps, not the least virtue of this book. The printing is of the excellence and accuracy which one expects from the publishers.

W. R. Day.

12.12 : 44.3 (489). Ferdinandsen, C., and Jørgensen, C. A. Skovtræernes Sygdomme. [**The diseases of forest trees.**] Gyldendalske Boghandel, Nordisk Forlag, Copenhagen. 1938–9. pp. 570. [Da.]

This comprehensive book is dedicated to the memory of Emil Rostrup, whose 'Plantepatologi', published in 1902, has been the fundamental work on Danish forest pathology. Rostrup's work, however, was equally concerned with diseases of agricultural and horticultural plants and has become seriously out of date. 'Skovtræernes Sygdomme', the outcome of ten years' preparatory work by the joint authors, is designed to replace 'Plantepatologi', so far as the latter dealt with forest pathology, and to give a fully up-to-date presentation of the subject.

The work is divided into two parts, the first of which contains a brief outline of the structure and development of fungi and a general account of the theory of pathology. Concise sections deal lucidly with the history of plant pathology, saprophytism and parasitism, infection and the development of disease, sources and means of infection, susceptibility and resistance, the technique of pathological investigation, and legal powers for the control of plant diseases.

The special part, which makes up the bulk of the work, is introduced with a conspectus of the classification of fungi, followed by four chapters in which the pathogenic fungi are systematically arranged by families and genera, with keys for their identification. For each important species the relevant information is given in a uniform order: symptoms of disease, cause and development of disease, distribution (geographical and by host species), economic importance, and control. The space devoted to the species varies greatly with their importance; as might be expected, an extremely detailed treatment is accorded to *Fomes annosus* (57 pp.) and *Armillaria mellea* (20 pp.), by far the most important fungi in Danish forestry.

In the succeeding portion of the work timber fungi, nursery diseases, mycorrhiza and bacterial nodules, and bacterial diseases each receive a separate chapter. The inclusion of mycorrhiza and root nodules in a work on forest pathology is justified by the authors on the grounds that the boundary between symbiosis and parasitism is indefinite, and that no recent comprehensive review of the subject exists in Danish. The work concludes with a key to the fungi arranged by host species, a comprehensive bibliography occupying twenty-two pages, and a full index.

It should be noted that although the authors' nomenclature of the fungus species does not always agree with that generally used in mycological literature, the corresponding synonyms can be traced by means of the index.

A conspicuous feature of the work is the generous use of photographs and diagrams, almost all original and of high quality, to illustrate the text. The production of both text and figures is beyond reproach, as befits a work that should become a landmark in Scandinavian forest pathology. 'Skovtræernes Sygdomme' deserves a much wider public than it is likely to get; it is a great pity that it could not have been published in some better-known language. P. G. B.

11.1–2 : 02. **The meteorological observer's handbook.** 1939 edition. H.M. Stationery Office, London. 1939. pp. 158.

38 : 31. LANGLANDS, I., and THOMAS, A. J. **Handbook of structural timber design.** *Tech. Pap. Div. For. Prod. Aust.*, No. 32. 1939 [?]. pp. 283.

92 (82). MADUEÑO, R. R. El regimen forestal argentino. Leyes, decretos, resoluciones, y disposiciones vigentes que lo definen y orientan. [**The forestry régime of the Argentine. Laws, decrees, resolutions, and standing orders that define and direct it.**] Buenos Aires. 1939. pp. 295. [Span.]

NOTES FROM ANNUAL REPORTS

Reports examined include: *Assam*: Quinquennial review of the forest administration for the years 1934–5 to 1938–9, with the progress report for the year 1938–9. *Bihar*: Annual progress report on forest administration for the year 1937–8. *Bombay*: Forest administration report for the year 1938–9. *Eire*: Report of the Minister for Lands on forestry for the period from 1st April, 1933, to 31st March, 1938. *Finland*: Suomen virallinen tilasto. XVII Metsätilasto. 37. Kertomus metsähallinon toiminnasta v. 1938 [Official Statistics of Finland. XVII. Forest Statistics. 37. Report on the activity of the Forest Administration during 1938.] *Gold Coast*: Annual report on the Forestry Department for the year 1938–9. *Jamaica*: Annual report of the Forest Branch of the Department of Science and Agriculture for the year ended 31st December, 1938. *Johore*: Report on forest administration for the year 1939. *Kepong*: Annual report of the Forest Research Institute, 1939. *Madras*: Administration report of the Forest Department for the year ending 31st March, 1939. *Maine*: Twenty-second biennial report of the Forest Commissioner, 1937–8. *Mauritius*: Annual report of the Forest Department for 1938. *New South Wales*: Report of the Forestry Commission for the period 1st July, 1937 to 30th June, 1938. *North-west Frontier Province*: Progress report on forest administration for the year ending 31st March, 1939. *Nova Scotia*: Report of the Department of Lands and Forests, 1939. *Palestine*: Report of the Department of Forests for the period 1936–9. *Queensland*: Report of the Director of Forests for the year 1938–9. *Saskatchewan*: Annual report on Forestry for year ending 30th April, 1939. *Sierra Leone*: Forestry report for the year 1938. *South Australia*: Annual report of the Woods and Forests Department for the year ended 30th June, 1939. *Southern Rhodesia*: Nineteenth annual report of the Division of Forestry for the year 1938. *Tanganyika Territory*: The eighteenth annual report of the Forest Department, 1938. *Tasmania*: Report of the Conservator of Forests for the year 1938–9. *Trinidad*: Report of the Governing Body of the Imperial College of Tropical Agriculture and the Principal's Report to 31st December, 1939. *Union of South Africa*: Annual report of the Division of Forestry for the year ended 31st March, 1939. *United Provinces*: Annual progress report of forest administration for the year 1938–9. *United States*: Report of the Chief of the Forest Service, 1939.

The numbers in brackets indicate the pages of the reports to which the annotations refer.

GENERAL FORESTRY

Eire. The area of land held for forestry purposes at the end of the period was 116,603·5 acres, while the total area of productive forest land was 94,715·5 acres (14).

Jamaica. The total area of forest land is 440,048 acres, of which 240,048 acres are Crown Lands and 200,000 acres private land (40).

New South Wales. The area of national forests totals 688,344 acres (1).

Sierra Leone. Many forest remnants, having the appearance of the true Rain Forest (possibly Tropical Semi-Evergreen Rain Forest), have been located in the Northern Province (9).

Union of South Africa. The indigenous forest totals 639,000 acres, of which about 130,000 acres are capable of timber production. Plantations of exotics total 350,000 acres (5–6).

SILVICULTURE

Assam. In some districts natural Sal regeneration has been established and developed from the whippy to the carroty stage at small cost, mainly by rains-weeding and fire protection (7). A certain degree of shade and protection from weed competition and insects are necessary for evergreen seedling establishment. Light is more essential to later development (7).

Bihar. Contour trenching, by reducing run-off and improving humidity conditions, has aided greatly in the establishment and growth of tree seedlings and grass (*Andropogon contortus*) on barren and eroded areas that otherwise would be unproductive during hot, dry weather. Tests taken at the end of six rainless weeks showed that trenched areas had relatively greater moisture contents at the 1 ft. and 3 ft. deep levels (13, 23). 'Early burning' is found to be unnecessary, and may even be harmful, in the regeneration of Sal forests, except possibly for extremely moist types (22).

Bombay. In thinning Teak coppice the retention of one stem per stool, rather than two or three, results in a higher diameter increment per cent. (35).

Eire. Douglas Fir has not been successful except on very sheltered, well-drained sites (18). Alder appears to be a good nurse tree for Spruce and hardwoods on heavy soil (20).

Finland. Swamp-drainage operations in 1938 covered an area of 18,077 ha. (83).

Gold Coast. For conditions existing in Ashanti the yield of *Cassia siamea*, on a 5-year rotation, is higher at a 7 × 7 ft. spacing than at 6 × 6 ft. Neem (*Azadirachta indica*) is used for swamp draining, and flush-stumping of coppice areas of this species and *C. siamea* is undertaken to prevent mosquito breeding in rot-holes (6).

Jamaica. Of a number of indigenous and exotic species used in afforestation, Cape Yacca (*Podocarpus elongatus*) gave best promise as regards survival (42).

Johore. Plantings of Yemane (*Gmelina arborea*) and Chengal (*Balanocarpus heimii*) have suffered heavily from drought (10).

Kepong. Kempas (*Koompassia malaccensis*) seed does not retain its viability for more than a month. Germination of Merbau (*Intsia palembanica*) seed may be hastened by breaking the seed coat with a single file stroke and soaking in water overnight before sowing. Treatment with dilute acid hastens the germination of seed of Mempoyan (*Rhodamnia trinervia*). Cold-chamber storage has failed to prolong viability in Dipterocarp seeds (3).

Madras. Mangrove swamp forests have produced satisfactory natural regeneration after clear-felling (18). Sandalwood is introduced into suitable localities by planting in small plots 15 ft. square ['propagation centres'] from which it may spread naturally into the surrounding forest (21). The beneficial effect of the pre-monsoon planting of Teak stumps flush with the ground has been confirmed. A considerable drop occurs in the yield of Teak stumps of suitable size if the same nursery beds are used year after year, even with manuring (22–3).

Mauritius. The measurement of sample trees in the indigenous forest indicated a very slow growth rate for the primary species, the mean diameter increment of Natte (*Mimusops* [*Imbricaria*] *maxima*) being less than 0·10 in. (10).

North-west Frontier Province. Given the right habitat and sufficient time, regeneration of Blue Pine (*Pinus excelsa*) will come in naturally where artificial regeneration is unsuccessful (21).

Queensland. An area of 2,780 acres was planted, mainly with softwood, bringing the total plantation area up to 22,019 acres (4). A root-wrenching board has been devised to offset the difficulties of root-wrenching drill-sown seedlings in heavy soils (6). Unpruned stems show a greater response to thinning than those pruned. While early thinnings of *Pinus taeda* are ineffective, a thinning in a stand averaging 27 ft. high, which reduces the density from 680 to 450 stems per acre, does increase the increment of the better trees. The species *Callitris glauca* requires wide spacing. The mean girth increment at a 15 × 15 ft. spacing was three times that of the fastest trees grown at 7 × 7 ft. (8).

South Australia. As a result of an investigation of pruning methods, it has been decided to discard the axe as a main low-pruning tool in favour of shears. Tests have also shown that high-pruning in two stages with saws of different length of handle is as cheap as attempting the whole operation with one saw (11).

Southern Rhodesia. A total of 770 acres was planted, bringing the area of plantations to 7,275 acres (80 per cent. conifers). Natural regeneration was noted for the exotic species *Pinus patula*, *Cupressus lusitanica*, *Acacia mollissima*, *Acacia melanoxylon*, and various Eucalypts (12).

Tanganyika Territory. Artificial regeneration of Mvule (*Chlorophora excelsa*) has been seriously affected by gall-fly attack. Attempts to control the gall-fly by use of shade are unsatisfactory as it appears that shade is very detrimental to the growth of Mvule (5, 10). Observations indicate that natural regeneration of Mkalikali (*Entandrophragma stolzii*) follows the removal of dense underwood (10).

Tasmania. An area of 331 acres was planted with a total of 90,792 trees (9).

Union of South Africa. 15,223 acres were afforested (17). Loss in diameter and height increment as a result of pruning up to one-half the living crown length, was found to be both slight and temporary. Investigations to date, using replicated plots, indicate that the Portuguese race of *Pinus pinaster* has a relatively high growth rate while Corsican and Esterel races are inferior. Suppressed *Pinus patula* trees (12 years old) respond to thinning in proportion to size at time of thinning, though continuing to fall behind in absolute increment in proportion to initial suppression (24).

United Provinces. Adequate fire protection will ensure natural regeneration of Chir (*Pinus longifolia*). In the forests of Chakrata natural regeneration of Deodar (*Cedrus deodara*) is uncertain and has been largely abandoned in favour of artificial methods (11–12).

EXTRACTION, UTILIZATION, AND MARKETING

Assam. The use of a rubber-tired cart in hauling sleepers resulted in a marked increase in the load carried and in benefit to the draught animals (buffaloes) (4). Among the uses for which indigenous timbers have been found suitable are: *Gmelina arborea* for jute mill rollers, *Podocarpus neriifolius* for shovel handles, *Terminalia myriocarpa* (seasoned) for flooring, and *Endospermum chinense* for packing cases (21).

Finland. A total of 3,797,570 cu. m. of wood was cut from State forests and marketed in 1938 (83).

Gold Coast. Neem and *Cassia siamea*, species that coppice freely and give good yields, are widely used for fuel (6). Treated Affina (*Strombosia pustulata*) and Flint Bark (*Diospyros sanzaminika*) are of value for telegraph poles in areas subject to corrosive sea winds (8).

Jamaica. Investigations into the question of railway sleepers, all of which are of native hardwoods, showed that, while their apparent average life is sixteen years, a large number have been in service for 35 years, and that 90 per cent. of the replacements in the past have been due to mechanical destruction and not to decay (43).

Kepong. Mechanical tests have shown that Chengal (*Balanocarpus heimii*) is suitable for power-line standards (13). After three months' storage (*a*) without bark in running or still water, or (*b*) with the bark on in the seasoning shed, logs of Pulai (*Alstonia* sp.) showed considerable depletion of starch and were rendered immune against attack by powder-post beetles (13–14). Poison-girdling of Kapur (*Dryobalanops aromatica*) had little effect upon the moisture content of the trees three months after their death (14). Telinga gajah (*Macaranga megalophylla*), Sendok-sendok (*Endospermum malaccense*), and Perah (*Elateriospermum tapos*) are readily impregnated with water-soluble preservatives by the tire-tube method (16). F.M.S. railways have decided to use treated Keruing (*Dipterocarpus* sp.) floorboards for their wagons (18).

Madras. A Swedish producer-gas lorry has been tried with success (4). Several grasses have proved suitable for paper-making, and *Cochlospermum gossypinum* gives pulp good enough for strawboards and cardboards (5).

New South Wales. Thinnings from plantations of *Pinus radiata* are being used in the manufacture of wood wool and fruit cases in local use (4).

Queensland. Turpentine (*Syncarpia laurifolia*) and Blue Gum (*Eucalyptus globulus*) have a marked superiority in use for marine piling or other work subject to attack by marine organisms. Creosote treatment of freshly-cut Hoop Pine (*Araucaria cunninghamii*) logs is the best preventive against attack by *Platypus* spp. Injections of creosote or half creosote and half kerosene solution into building timbers of Hoop Pine infested with *Calymmaderus incisus* should eradicate the beetle. Eggs stored for up to ten weeks in crates of badly blue-stained Pine were not affected (21). The density of wood from plantations of Hoop Pine, *Pinus taeda*, and *P. caribaea* is not inferior to that of virgin growth (23).

Tanganyika Territory. Results from 'graveyard' tests over a period of twenty-four months show that creosote impregnation is superior to water-soluble salts, except for certain timbers containing natural oils and for species of Leguminosae and Moraceae, for which corrosive sublimate seems best suited. Sodium arsenite is not effective against fungal attack (9).

Union of South Africa. A pulp and paper plant, capable of a 14,000-tons production of paper per year, has been established on the East Rand (8). One-inch boards of *Pterocarpus angolensis*, taken direct from the saw, were kiln-dried without degrade in fourteen days. Reports have been completed giving the properties and uses of *Grevillea robusta*, *Casuarina cunninghamii*, *Eucalyptus gomphocephala*, *E. maculata*, and *Celtis rhamnifolia* (26). Weight for weight, *Pinus insignis* gave values for bending strength 25 per cent. higher than imported Deal or other South African Pines so far tested. Strength tests show that the species *Cedrus deodara*, *Pinus caribaea*, *P. insignis*, and *P. pinaster*, have the same values for use as telephone poles, while *P. patula* requires a larger diameter for equivalent strength (27).

United Provinces. Tests show that a cheap zinc-chloride preservative can be used in the treatment of Haldu and Kanju (*Holoptelea integrifolia*), thus making available a cheap wood for electric casings and cappings (60–61).

United States. High-yield pulps that are readily converted to high-quality corrugated stock have been obtained from Blackjack Oak (*Quercus marilandica*) and Red Gum (*Liquidambar styraciflua*) by means of the semi-chemical process (24).

MINOR PRODUCE

Kepong. Experiments with trees of *Dyera* sp. showed that a resting period of three months in the year resulted in higher yields of Jelutong latex and a saving in bark consumption and tapping costs. There was no significant difference between the dry Jelutong contents of the rested trees and those tapped continuously (19).

PROTECTION

Bombay. Ravlook crickets (*Brachytrypes achatinus*) caused considerable damage to plantations of *Casuarina* and one-year-old Teak plants (9).

Eire. In general Douglas Fir has been heavily attacked by *Adelges cooleyi*, though damage is less severe in plantations with a mixture of Larch (19, 24). A special gun cartridge which gives off lethal gas was found useful in controlling rabbits and hares on rocky ground and where the burrows are small and scattered (23).

Gold Coast. The drought die-back disease of Cacao appears to be associated with excessive deforestation. Work on this problem includes the establishment of barrier reserves to control the encroachment of savanna forest (3). It appears to be fairly easy to establish closed forest in savanna areas adjoining the present closed-forest zones. Fire hazard is a negligible factor in the closed forest, and there appears to be little difference between early burning and complete protection as affecting its rapid establishment (7).

Kepong. Records of defoliation of *Endospermum malaccense* by larvae of *Urapteroides astheniata* show a regular annual rhythm of infestation which suggests that high precipitation is unfavourable to the larvae (20).

Madras. Chemical spraying of a small area of Lantana appeared to be effective (15).

Maine. Forest insects causing most damage in 1937–38 were Balsam woolly aphid (*Adelges piceae*), Beech scale (*Cryptococcus fagi*), Larch case-bearer (*Coleophora laricella*), yellow-headed Spruce sawfly (*Pikonema alaskensis*), Eastern Spruce bark beetle (*Dendroctonus piceaperda*), Red Pine sawfly (*Neodiprion* sp.), Pine needle miner (*Paralechia pinifoliella*), and European Spruce sawfly (*Diprion polytomum*) (70–2).

Nova Scotia. The parasites *Microplectron fuscipennis* and *Extenterus* sp. were liberated in large numbers as a possible control of the Spruce sawfly (35–6). The Larch sawfly (*Pristiphora erichsoni*) and the Larch case-bearer each destroyed a quantity of foliage but few trees were fatally injured (36).

North-west Frontier Province. Poplar, Walnut, and Willow, planted as cuttings on steep slopes, are proving effective in the conservation of soil and moisture (22).

Palestine. In sand-protection work along the railway, plants such as Artemisia, Marram Grass, and Tamarisk, were used successfully to hold the sand in place, and tree species such as *Acacia cyanophylla*, *Eucalyptus camaldulensis*, *Cupressus sempervirens*, *Pinus halepensis*, and *Schinus molle* (Pepper), are showing good growth, the first of these species forming dense stands on sand dunes. *Eucalyptus*, *Casuarina equisetifolia*, and *Cupressus* have been planted at desert stations as windbreaks, their relative success being in the order named (31). Trench terraces have been successful for soil and moisture conservation and the establishment of vegetation on steep slopes. The placing of cut foliage on the loose sand between planted rows of Acacias keeps the sand in place and probably reduces the soil temperature (9).

Queensland. Mycorrhizal relationships of the fused needle disease of Pine appear to be firmly established. Application of phosphate is the most effective treatment of this disease, whereas ammonium sulphate depresses tree growth and increases the severity of the disease. The severity of root rot, caused by *Fomes pachyphloeus* on plantation trees, is reduced when stumps of the preceding rain-forest stand are well rotted. *Phyllosticta* sp. causes a leaf-cast disease of Silky Oak

(*Grevillea robusta*) (9). Chlorosis of Hoop Pine, due to nitrate deficiency, may be controlled to some extent by the addition of ammonium sulphate to nursery beds, while the application of ground sulphur is a cure for chlorosis caused by an alkaline soil reaction (9, 11). The reproduction and development of the Pine bark weevil (*Aesiotes notabilis*), which breeds in several exotic conifers and native species, is favoured by high humidity (10). Thrips (*Oxythrips* sp.) on Kauri Pine (*Agathis australis*) have been controlled with a nicotine sulphate spray (11). New types of portable radio transceivers, operating on a wave length of about a hundred metres, are satisfactory up to ten miles under conditions other than direct air line (11).

Saskatchewan. The issue of 'burning' and 'travel' permits is found to be an efficient method of fire prevention, giving forest officers information on proposed burning and on the movement of travellers through the district, and also making the permittee more careful (13). A Junior Forest Warden Association is being formed to interest boys in forest conservation and fire-prevention work. Long narrow pastures that will act as fire guards are being fenced along the boundaries of settled areas (14).

South Australia. Arsenical spraying against case moths on *Pinus radiata* appears to have been effective. Grasshoppers (*Phaulacridium vittatum*) were successfully controlled at a forest nursery by placing a loose hessian fence around the nursery and laying poison bait (7).

Southern Rhodesia. An effective treatment for damping off in seedbeds of *Pinus palustris* and *P. caribaea* was a solution of one fluid ounce of commercial sulphuric acid in one gallon of water (13).

Trinidad. Information has been obtained on the relative susceptibility of a large number of local timbers to attack by subterranean termites. Species of *Anoplotermes* have been found to be abundant in the top soil of forests (23–4).

Union of South Africa. Following damage by hail, *Pinus insignis* was heavily attacked by the disease *Diplodia* (15). The scale insect *Coccus hesperidum*, observed on *Pinus pinaster*, was controlled by two sprayings of Volck oil (25).

ECONOMICS, MANAGEMENT AND POLICY

Bombay. Controlled sheep grazing has resulted in improved quality of grazing and has not hindered profuse regeneration of Khair (*Acacia catechu*), Nim (*Azadirachta indica*), and Salai (*Boswellia serrata*) in the open forests of the South Indian dry mixed deciduous type (37).

Johore. A new forest reserve of 1,450 acres was gazetted (1–2).

Madras. Large and increasing areas of forest land have been made available for cultivation by the poorer classes, grazing facilities have been increased, and fees reduced (1). Concessions for the removal of dead wood have been extended. Inducements are offered to peasants to co-operate in reforestation by the combined forest-and-field-crop method (6).

Nova Scotia. Over half the timber cut was immature, and as a result of the war, the cutting of undersized trees is increasing (26–7).

Saskatchewan. An amendment to the United States Revenue Act 1938 removed the excise tax of $1·50 per 1,000 board ft. on Western White Spruce (2).

Union of South Africa. Alinement charts and volume tables were completed for *Pinus canariensis* and *P. taeda* (23).

United States. Instances are given of farm forest co-operatives that have proved successful in increasing farmers' cash income, and in reducing relief costs through profitable employment of labour (12–3). Improvement in management and marketing has increased the gross income from woodlands by 50 per cent. on some farms in the Lake States (15). In northern hardwood stands light selection cuttings that remove only one-third of the merchantable volume result in a considerably higher annual increment per acre than cuttings removing two-thirds of the merchantable trees. Selection management of second-growth Shortleaf and Loblolly Pine stands in the South is found to be profitable (23).

NOTES FROM THE DAILY AND THE NON-TECHNICAL PRESS

Forestry Abstracts is primarily concerned with scientific and technical information on forestry. But forestry officers, especially those engaged in administration, are also interested in the general trend of forestry throughout the world as shown by current information on government policy, new sources of supply, developments in methods of exploitation or conservation, etc. etc. Information of this type frequently appears in the daily press of a country long before detailed accounts are to be found in technical or government publications. A section containing such information taken from articles in the daily and non-technical press has therefore been added.

Every effort will be made to record only statements of fact and to avoid obvious propaganda and unsupported speculation, but it must be borne in mind that the articles from which this information is taken are usually unsigned and will rarely have been written by forestry officers for forestry officers.

Acknowledgements are due to the Foreign Research and Press Service of the Royal Institute of International Affairs for supplying press cuttings referring to forestry.

References: 1. *The Baltic Times*, Tallinn. 2. *El Diario Ilustrado*, Santiago. 3. *L'Evènement-Journal*, Quebec. 4. *Jornal do Comércio e das Colónias*, Lisbon. 5. *El Mercurio*, Santiago and Valparaiso. 6. *The Mercury*, Hobart. 7. *Messager d'Athènes*, Athens. 8. *Montreal Gazette*, Montreal. 9. *La Nacion*, Buenos Aires. 10. *La Nacion*, Santiago. 11. *La Presse*, Montreal. 12. *Südost Economist*, Budapest. 13. *Westdeutscher Beobachter*, Cologne. The numbers in brackets indicate the reference number and the date of publication of the newspapers to which the annotations refer.

Argentine. A Division of Forestry is being created under the Ministry (Dirección) of Agriculture. One of the main duties of the new Division will consist in a survey of forest resources (**9**; 3.5.40).

Australia. An organized scheme for the appointment of bush fire wardens has been in operation in Northern Tasmania for some months and is now being undertaken by the Forestry Department in the South of the State. The duties of the wardens include organization of brigades of men willing to act during bush fire periods, and of those willing to provide transport in case of emergency. Each warden has in his care fire-fighting equipment. Wardens are notified of emergencies by fire patrols who are maintained in the forestry areas during the hazard season. The appointments of wardens are part-time and are made under the Bush Fires Act (**6**; 9.4.40).

Canada. An extensive forest protection campaign has been launched by the Canadian Forestry Association. In 1939 forest fire damage totalled $2,730,000—a low figure if compared with the damage during the ten preceding years which averaged $5,000,000 annually. The educational campaign of the Association is already well in hand in Montreal, Quebec, Shawinigan Falls, and Chicoutimi, while in Three Rivers and Sherbrooke recruitment of new members is being initiated on a large scale. In each of the towns a Chairman of Campaign will be in charge of propaganda and will direct an enquiry into the dependence of local industries on forestry (**3**; 26.4.40 and 30.4.40. **11**; 30.4.40).

An order-in-council, adopted at the Quebec Provincial Cabinet meeting of 10th May, stipulates that all persons who travel through forests of the Province from 11th May to 15th November must obtain a permit from the Quebec Ministry of Lands and Forests. The permit is furnished free of charge and will allow authorities to exercise control over circulation in the forests and thus assure some measure of protection to the woods (**8**; 11.5.40).

Chile. The critical position of timber producers in Chile has been aggravated by the loss of the German market, by selling difficulties in Argentine resulting from high freight costs and tariffs, which make it difficult to compete with Paraguay and Brazil, and by speculation within the country (**10**; 25.2.40). On 1st March the Government decided to help producers and to check speculation by fixing minimum and maximum prices for each kind of timber and by purchasing large stocks direct from the producers for both inland consumption and export (**5**; 2.3.40. **10**; 2.3.40). On 13th March it was decided to purchase a stock of 10 million Pesos worth of timber to be employed in reconstruction work in the zone devastated by a recent earthquake. (Exchange approximately

95 Pesos = £1) (**5**; 14.3.40). It was further agreed that the Government should acquire a large conversion plant (**5**; 23.3.40); this was severely criticized as 'undue competition with private enterprise' (**2**; 25.3.40).

Estonia. The 'National Resources Research Institute' has just completed an investigation on Estonian shale oil. This oil is more toxic than creosote and is less subject to evaporation and lixiviation. Penetration by either the Rüping or Bethell process is satisfactory. The shale oil does not corrode metals and is harmless to human beings and animals. It is available in practically unlimited quantities, and since 1923 over 2 million railway sleepers and tens of thousands of posts have been impregnated with it. Of the sleepers treated 15 years ago, only 3 per cent. have had to be replaced so far, and these owing to mechanical defects. Estonian shale oil is used by Swedish and Lithuanian, as well as Estonian railways. Recent experiments at the Valga wood-treating plant showed that the oil penetrates well pre-dried blue-stained timber (**1**; 8.2.40).

Germany and Poland. In an article entitled 'Forestry in the liberated East', an estimate is made of the amount of timber which Poland is likely to contribute to Germany's war economy. At present Germany consumes annually about 80 million solid cu. m. of timber, of which only about 56 million cu. m. are produced in Germany proper and in Austria (by cutting 150 per cent. of the increment). It is thought that with the aid of supplies from Poland involving over-cutting in the State and private forests of that country, it will be possible to restrict German imports by 6–8 per cent. The Wartha district is already supplying mining timber for Upper Silesia. Two hundred foremen have been brought from Germany to supervise Polish labour in that district. Afforestation in Poland is envisaged for the future (**13**; 24.4.40).

Greece. Forestry credits granted by the Rural Bank of Greece were considerably augmented in 1938, the second year since their institution. This was due largely to the fact that the recently founded forestry co-operatives [cf. Kontos' article, *For. Abs.* 1 (198)] have made good progress in spite of adverse conditions such as the rise of transport costs and the lowering of timber prices. The forestry loans amounted to a total of Dr. 81,369,932 and were: (1) Short term loans (to resin producers, etc.), Dr. 27,075,075, (2) medium and long term loans, Dr. 41,525,453, and (3) loans for the clearing of forests, Dr. 12,769,404. (Exchange approximately 520 Drachmæ = £1) (**7**; 8.2.40).

Latvia. The Forest Days held in Latvia in the spring of every year are now taking place for the eleventh time. Since 1936, when the State undertook to restock all depleted areas in private woodlands at its own cost or to repay the owners for expenses incurred in this connection, the work done during Forest Days has consisted chiefly in demonstrations of exemplary work and in forestry propaganda in the shape of excursions, lectures, and film performances. A special central committee representative of several authoritative bodies and numerous local committees are in charge of the Forest Days, which are financed chiefly by the Forestry Department. It has usually been the custom to associate the Forest Days with some particular problem. This year the slogans are: 'An orchard for every homestead' and 'Useful timber within easy reach' (**1**; 3.5.40).

Peru. The Government has decreed the creation of a Forest Service (Servicio de reforestación nacional). Three centres are to be established in the north, centre and south of the Republic, respectively. The first task of the Service will consist in a census of woodlands (**9**; 19.4.40).

Portugal and Colonies. The 500,000 ha. of Angola's forests have scarcely been utilized so far. These forests contain many species suitable for paper-pulp production (**4**; 5.1.40), including the easily floatable Mulimba (*Terminalia superba*) which is represented in large quantities in Mayombe and the export of which from the Belgian Congo, where it is known as 'Limba', has increased greatly in recent years (**4**; 29.11.39). Before the war attempts to import timber from Angola broke down mainly owing to shipping difficulties, which made competition with Brazilian supplies practically impossible (**4**; 23.2.40). The inadequacy of Landana Harbour for timber loading purposes is still considered a serious obstacle, but prospects appear brighter now that Brazilian and Scandinavian supplies are scarcely forthcoming (**4**; 28.2.40).

Slovakia. A recent decree stipulates that all forest seed, which is to be used for afforestation within the country or for export, must first be examined and certified by the Official Research Institute. Slovakia's annual demand of saplings amounts to about 80 millions (**12**; 19.1.40).

From an article on the timber economy of Slovakia:—The main source of economic life in the newly created State is its timber resources. One-third of the country is covered with forests,

and one-third of the forest area of 1·4 million ha. is owned by the State. The forests of Slovakia are 30 per cent. conifers, 48 per cent. broadleaved species, and 22 per cent. mixed stands. Of the annual yield of about 4·5 million cu. m. one-half is exported and over 80 per cent. of the exports go to Germany and the Protectorate of Bohemia-Moravia. Under the five-year plan for 1940–5, which is being elaborated, activities under the recently formed 'Council for Timber and Forestry' will occupy the most prominent place, with forestry, wood-utilization industries, and the timber trade being placed under strict State control. There are 6 cellulose factories in the country consuming almost 1 million cu. m. of timber and at present there appear to be good prospects for an increase of cellulose exports from Slovakia. Wood utilization by the cellulose factories is still very wasteful and in future the industry will be forced to use as much as possible of thinnings and other small-sized material (**12**; 29.3.40).

LIST OF ADDITIONAL ABBREVIATIONS

(Based on the *World List of Scientific Periodicals*)

Adv. Leafl. Qd. For. Serv.	Advisory Leaflet. Queensland Forest Service. Brisbane.
Ann. appl. Biol.	Annals of Applied Biology. Cambridge.
Ann. Univ. Stellenbosch	Annals of the University of Stellenbosch. Capetown.
Ber. dtsch. bot. Ges.	Bericht der Deutschen Botanischen Gesellschaft. Berlin.
Bot. Zh.	Botanicheski Zhurnal. Moscow and Leningrad.
Bull. Brooklyn ent. Soc.	Bulletin of the Brooklyn Entomological Society. Brooklyn, N.Y.
Bull. Dep. Agric., Jamaica	Bulletin. Department of Agriculture. Kingston, Jamaica.
Bull. For. Bur. Aust.	Bulletin. Commonwealth Forestry Bureau. Canberra.
Bull. Inst. agron. Gembloux	Bulletin de l'Institut agronomique et des Stations de Recherches de Gembloux. Gembloux.
Bull. La. Conserv. Dep.	Bulletin of the Louisiana Conservation Department. Baton Rouge.
Bull. Soc. bot. Fr.	Bulletin. Société botanique de France. Paris.
Bull. U.P. For. Dep.	Bulletin. United Provinces Forest Department. Allahabad.
Bull. Univ. Mont.	Bulletin of the University of Montana. Missoula.
Bull. Wis. Dep. Agric.	Bulletin. Wisconsin Department of Agriculture (and Markets). Madison.
Chemikerztg.	Chemikerzeitung. Cöthen, Anhalt.
Circ. Conn. agric. Exp. Sta.	Circular. Connecticut Agricultural Experiment Station. New Haven.
Circ. Dom. For. Serv.	Circular. Dominion Forest Service. Ottawa.
Circ. Ill. nat. Hist. Surv.	Circular. Illinois Natural History Survey. Urbana.
Circ. N.C. Dep. Conserv.	Circular. North Carolina Department of Conservation and Development.
Circ. U.S. Dep. Agric.	Circular. U.S. Department of Agriculture. Washington.
Dokl. vsesoyuz. Akad. s-kh. Nauk	Doklady Vsesoyuznoy Akademii Sel'skokhozyaystvennykh Nauk im. V.I. Lenina. Moscow.
Dtsch. Forstw.	Der Deutsche Forstwirt. Berlin.
Econ. Note Lake St. For. Exp. Sta.	Economic Note. Lake States Forest Experiment Station. St. Paul, Minn.
Elect. World, N.Y.	Electrical World and Electrical Engineer. New York.
Engng. J., Montreal	Engineering Journal. Montreal.
Erdész. Kisérl.	Erdészeti Kisérletek. Sopron.
Flora, Jena	Flora, oder allgemeine botanische Zeitschrift. Jena.
For.-Fire Res. Note	Forest-Fire Research Note. Dominion Forest Service. Ottawa.
For. Surv. Release Appal. For. Exp. Sta.	Forest Survey Release. Appalachian Forest Experiment Station. Asheville, N.C.
For. Surv. Release Nth. Rocky Mt. For. & Range Exp. Sta.	Forest Survey Release. Northern Rocky Mt. Forest and Range Experiment Station. Missoula, Mont.
For. Surv. Release Sth. For. Exp. Sta.	Forest Survey Release. Southern Forest Experiment Station. New Orleans, La.
J. Malay. Br. Asiat. Soc.	Journal of the Malayan Branch of the Royal Asiatic Society. Singapore.
J. S. Afr. For. Ass.	Journal of the South African Forestry Association. Pretoria.
Medd. ProvnAnst. Stockh.	Meddelanden från Statens Provningsanstalt. Stockholm.
Meded. LandbHoogesch. Wageningen	Mededeelingen van de Landbouwhoogeschool. Wageningen.
Misc. Publ. Calif. For. & Range Exp. Sta.	Miscellaneous Publications. California Forest and Range Experiment Station. Berkeley.
Misc. Ser. N.Z. For. Serv.	Miscellaneous Series. New Zealand State Forest Service. Wellington.
Mon. News Lett. Div. For. Prod. Aust.	Monthly News Letter. Division of Forest Products, Department of Scientific and Industrial Research. Melbourne.
Monsanto tech. Bull.	Monsanto Technical Bulletin. Monsanto Chemical Co., St. Louis, Mo.

LIST OF ADDITIONAL ABBREVIATIONS

Natuurwet. Tijdschr.	Natuurwetenschappelijk Tijdschrift. Antwerp.
N.Z. J. For.	New Zealand Journal of Forestry. Wellington.
Occ. Pap. Sth. For. Exp. Sta.	Occasional Paper. Southern Forest Experiment Station, New Orleans, La.
Pamphl. Coun. sci. industr. Res. Aust.	Pamphlet. Council for Scientific and Industrial Research, Australia. Melbourne.
Pan-Pacif. Ent.	Pan-Pacific Entomologist. San Francisco.
Paper Ind.	Paper Industry. Chicago.
Paper Mill	Paper Mill and Wood Pulp News. New York.
Pulp Paper Mag. Can.	Pulp and Paper Magazine of Canada. Montreal.
Res. Bull. Ia. agric. Exp. Sta.	Research Bulletin. Iowa Agricultural Experiment Station. Ames.
Res. Note Nth. Rocky Mt. For. & Range Exp. Sta.	Research Note. Northern Rocky Mountain Forest and Range Experiment Station. Missoula, Mont.
Res. Note Sthwest. For. & Range Exp. Sta.	Research Note. Southwestern Forest and Range Experiment Station. Tucson, Ariz.
Rev. int. Prod. colon.	Revue internationale des produits coloniaux. Paris.
Silvic. Res. Note Dom. For. Serv.	Silvicultural Research Note. Dominion Forest Service. Ottawa.
Spec. Rep. For. Prod. Res., Lond.	Special Report. Forest Products Research, Department of Scientific and Industrial Research. London.
Sth. Pulp Paper J.	Southern Pulp and Paper Journal.
Symb. bot. upsaliens.	Symbolae botanicae Upsalienses. Uppsala.
Tasm. J. Agric.	Tasmanian Journal of Agriculture. Hobart.
Tech. Bull. Calif. Redwood Ass.	Technical Bulletin. California Redwood Association. San Francisco.
Tech. Note Appal. For. Exp. Sta.	Technical Note. Appalachian Forest Experiment Station. Asheville, N.C.
Tech. Note Ohio agric. Exp. Sta.	Technical Note. Ohio Agricultural Experiment Station. Wooster.
Timb. Tr. J.	Timber Trades Journal. London.
Tr. Circ. Coun. sci. industr. Res. Aust.	Trade Circular. Council for Scientific and Industrial Research, Australia. Melbourne.
Tr. Promotion Ser. U.S. Dep. Comm.	Trade Promotion Series. U.S. Department of Commerce. Washington.
Trav. Lab. for. Toulouse	Travaux du Laboratoire forestier de Toulouse. Toulouse.
Trud. lesotekh. Akad. Kirov.	Trudȳ Lesotekhnicheskoy Akademii im. S.M. Kirova. Leningrad.
Univ. Sydney Publ. Geogr.	University of Sydney Publications in Geography. Sydney.
Univ. Wash. For. Cl. Quart.	University of Washington Forest Club Quarterly. Washington.
W. Cst. Lumberm.	West Coast Lumberman. Seattle.
Wood Pres. News	Wood Preserving News. Chicago.
Z. angew. Ent.	Zeitschrift für angewandte Entomologie. Berlin.
Zh. Inst. bot. Akad. Nauk U.R.S.R.	Zhurnal Institutu Botaniki Akademii Nauk U.R.S.R. Kiev.

Libraries, other than that of the Imperial Forestry Institute, from which literature was obtained for purposes of recording and abstracting in the present number of *Forestry Abstracts*.

Designation:	*Library of*:
I.I.E.	Imperial Institute of Entomology. London.
L.S.	The Science Library. London.
O.B.D.	The Department of Botany. Oxford.
O.R.E.	The School of Rural Economy. Oxford.
O.R.S.	Radcliffe Science Library. Oxford.
P.R.	The Forest Products Research Laboratory. Princes Risborough.

Publications of the I.A.B. referred to in this number:

Pl. Breeding Abs.	Plant Breeding Abstracts. Cambridge.
R.A.E.	Review of Applied Entomology. London.
R.A.M.	Review of Applied Mycology. Kew.
S. and F.	Soils and Fertilizers. Harpenden.